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VALUE OF THE SERVICE AND COST OF THE SERVICE.

There has been considerable difference of opinion and misunderstanding relative to the 1914 report of the Rate Research Committee of the National Electric Light Association, in which "value of the service" as a factor in rate-making was recommended to the careful consideration of the central stations throughout the United States.

The report considers and approves of the "cost-of-service" theory, but it points out that any cost-of-service theory that has yet been developed, cannot be applied to the small user, but that the rate at which electricity must be sold to this user is always lower than the cost of service would indicate, and is governed by expediency or political considerations.

On the other hand the rates for the very large and long-hour users must again depart from the cost-of-service theory because such theory is based upon many arbitrary averages, and the result seldom represents the true cost to a company of serving such users.

The Committee therefore called attention to the fact that for this class of business the value of the service is a good test and on the whole perhaps a better test than the cost analysis. The report does not advocate the abandonment of cost, but recommends the "value of the service" as the best method of arriving at a correct price for certain consumers and must be used to produce a proper growth and development of the business. It was specifically pointed out that the cost should be carefully considered, but should always be checked by the value of the service.

It seems very doubtful if many have carefully read the report, and the critics seem to prefer a careless hearsay opinion of what the report contains, to a careful study of its contents.

For instance, a reputable commercial organization in criticising the Rate Research Report before a public service commission used the following language:

"The Rate Research Committee . . . justifies competition, or what the traffic will bear, as the basis for the schedules of rates for its members. The small consumers must pay any price that may be imposed upon them, while the large consumers may purchase current at whatever price they may be able to produce it for with their own machinery."

Such criticism entirely ignores the real purpose of the report, which was to propose a practical basis of

rate-making, which would so reduce the fixed charges which existing customers must pay, that year by year reductions in all rates, and especially reductions in the rate to the very small users, would be possible.

That the critics of the Rate Research Committee have made very little study of the development of electric rates is plainly evident. One would think from such criticism that the theory proposed by the Rate Research Committee was entirely a new theory, while in fact, many of the commissions have clearly recognized this theory in their rate decisions.

The importance of the theory was mentioned in the 1913 report of the Board of Gas and Electric Light Commissioners of Massachusetts, in the following statement:

"The company's customers may be broadly divided into two groups, those who are dependent upon the company for their supply and those who may readily supply themselves in other ways or by other forms of power. To the first the company may dictate the price, controlled only by motives of business expediency, its own sense of justice and its duty as a public servant. To the second the company must so fix the price as to secure the customer's business or else go without it. The variety and wide range of the prices offered by the company are ample evidence to its recognition of these facts."

The Wisconsin Railroad Commission, and Commissioner Erickson is his many public papers, have clearly shown that the "value of service" must be used if progress is to be made.

Very recently the California Railroad Commission in a case against the Southern Pacific Company regarding a suburban railway, in calling attention to the importance of the value of service in the rates for railway companies, proves the point by calling attention to the correctness of the theory of the value of service for electric companies. This decision is particularly important because early in the summer this commission tried to base electric rates on the pure cost of the service, and a few months after, was obliged to abandon the cost-of-service theory for the value-of-service theory. In the Southern Pacific decision the Commission says as follows:

"In short, from the standpoint of what traffic will bear, a sufficient and legitimate doctrine, if properly understood and circumscribed, but not as usually urged by the carriers, the apportionment here must fall, for the limiting maximum rate beyond which the carrier may not go and hold his traffic is always the amount the patron can afford to pay, while the limiting minimum rate below which the carrier cannot afford to do the business is the actual added cost to the carrier of such business over the cost which such carrier must for other and independent reasons incur. In short, it has appeared to us that both the courts and commissions have been in error in determining the lowest rate that a utility may reasonably and lawfully afford. This rate, the courts and commissions to the contrary notwithstanding, may be and often is below the actual cost of performing an average unit service. For example, in the case of a hydroelectric company, it may be that the actual units of power available cost, unit for unit, a certain amount in actual out-of-pocket expenditure. Therefore, if we view this subject superficially, we would immediately say that this company could not afford to furnish its commodity at a less rate than the actual out-of-pocket cost per unit. But on inspection, it may appear that by reason of the impossibility of operating in every instance to maximum efficiency, there is excess property and excess expense incurred in performing the total service performed at any one time, which will not be appreciably, if at all, increased by performing some additional service. Therefore, when it becomes a question of performing or not performing the additional service, under the circumstances stated, the utility does not and should not look to the average expense of performing the unit of service, but look to the added cost and the added revenue alone, which added cost may be much less than the average cost per unit and which added revenue may be less than the average revenue that must be required per unit. Therefore, in determining whether or not such added business shall be done, the considerations we have herein discussed are the ones a wise economy will require to be studied."

This decision fully sustains the Rate Research Committee's report of 1914, and were the critics of that report to study it carefully, and study some of the more important decisions on the subject, before jumping to rash conclusions, they could learn much as to what the report contained, and its fundamental fairness.

ELECTRIC CHRISTMAS DECORATIONS.

The approach of the annual period of Christmas-tree perils from the use of open candle flames presents the opportunity of advertising and urging the use of electric lamps for this sort of decoration. While it is true that Christmas trees are in use for but a short period, and the energy consumption during that period is not great, the aggregate of a large number of such applications will appreciably increase the central-station output. Moreover, when an outfit of this kind is once in hand, it is likely to be used at other times for general decorations, and not merely reserved for future use on the Christmas tree.

Statistics collected by the fire insurance companies show that Christmas Day and the week following are every year conspicuous for an added number of fires from the use of lighted candles upon Christmas trees, and these often result in injury or death to the children for whose amusement and delight they are procured. Emphasis on this point will encourage the sale of decorative electric lamps and every use of an electrical device is an entering wedge for some other current-consumer that may be of far more importance from the consumption standpoint than the original device.

THE MISSION OF ELECTRICAL ENGINEERING.

As the boundaries of electrical application are continually being pressed farther and farther beyond the former lines, the multiplication of its departments is compelling those who follow it as a means of livelihood—whether in profession or in trade—to specialize very soon after they have acquired that knowledge of the fundamentals that is common to all. What we understand as the main branches of engineering are not more numerous or more definitely distinctive than the different sections of electrical engineering are rapidly becoming. And quite fittingly it follows that most of us become so absorbed in the pursuit of our own particular interest that we find ourselves becoming more or less expert in that direction, allowing of only a merely occasional diversion in the branches affected by our confrères. True, there are exceptions where men of genius and of versatility in application leave a permanent impress on many sections; but these are very rare and we are most of us among the majority. Therefore it is well for us that at times somebody with a master mind should draw us all in from our different sectional concerns and remind us that there is a mission common to us all.

This was done for English electrical engineers in November by Dr. A. J. Railing in his address as chairman of the Birmingham local section of the Institution of Electrical Engineers. This address differed from those of the other sections opening the season in that it left the subject of the war alone and was an invitation to electrical men to change from thoughts of national character to reflections of common interest and profit to all electrical minds everywhere. The position of electrical engineering in the world's social organization—that, said Dr. Railing, is a subject which must be close to the heart of every electrical engineer. He endeavored to show how and why in the chain of occupations and professions the advent of the electrical engineer has been of necessity a late one; how he, like most late developments, therefore represents one of the most highly developed organisms; and how he must realize his position as such, "with all the duties of the later-born to stand on the shoulders of past generations, above them, with a larger circle of vision." Consequent thereupon comes the duty to use the accumulated experience of the intermediate formations for the purpose of achieving further progress, the duty to advance the age and the professions which had produced him, until he in turn has led to new and higher developments, to an increase of matters humane and in nature, and to an increased knowledge of matter by man.

In considering how far electrical engineering already contributed to human development by improving human progress and efficiency, it appears that electrical engineering is a power for civilization if it increases mankind's efficiency in dealing with the following factors: (1) Enabling us to make better use of matter either by increasing the number of varieties in existence or by producing them more cheaply, or by making better use of their properties. (2) Enabling us to make better use of the available energies. (3) Increasing the space that can be inhabited and made use of by men. (4) Increasing the physical or mental power and efficiency of each individual. (5) Apart from increasing the efficiency of the individual, increasing the efficiency of its composite body—human society, either by increasing the average efficiency or by increasing the total efficiency.

It will be observed that Dr. Railing's theme was a thought-stimulating one of a largely philosophical kind. The advantageous influences of electricity were considered in turn in relation to all the classes of development work mentioned above. It was shown how, for example, the transformation of electric energy into mechanical energy led practically into every sphere of human activity. Advantages following therefrom had tremendously increased the output from coal-bearing areas, extended the areas worked, and cheapened the coal produced; they had hugely increased and cheapened the production of iron and steel; had resulted in a large increase in the cotton-industry productiveness, improved the uniformity of the product, and cheapened it. The broad effect thus was to immensely cheapen raw material and finished product, and consequently to increase individual and average comfort of living in producing centers.

Electricity was described as a great equalizer because it allows us to conveniently transform available energy. "It allows us to produce lower temperatures in hot climates, to produce heat in cold areas, it enables us to irrigate dry territories, and thereby bring them under cultivation, it allows us to build canals, and recover swamps. Activity of this kind is going on all over the world—in India, and on the Panama Canal; resulting everywhere in better living conditions and increasing the area which can be inhabited by man."

The last proof given for the mission of electrical engineering was its influence in improving the collective efficiency of mankind. Electricity has acted as the great democratizing agent. It has taught us to make full use of the materials and energies available, and by cheapening production and transportation has made commodities and tools which were the properties of the few, the tools and properties of the masses of mankind. It is further replacing to an ever increasing extent manual labor by the use of other available energies, and in so doing it confers a further boon on human society by freeing man's energies for their exercise in the form of mental energy. The tremendous progress in science during the last century is considered to be largely due to that fact.

Finally, in regard to the efficiency of the human race, electrical engineering has led to better understanding in many connections and to a more extended and more efficient use of nearly all existing matter and energy.

Philadelphia Company Section Meeting.

The second fall meeting of The Philadelphia Electric Company Section, N. E. L. A., was held on Wednesday evening, November 18. The speaker of the evening was Edward J. Cattell, statistician of the City of Philadelphia. The subject of his address was "Business Conditions as Affected by the War in Europe." The speaker lived for ten years in the district of Europe which is now the scene of an international conflict, and was, therefore, in a peculiarly fitting position to discuss his subject. Like many other thinkers upon the subject, Mr. Cattell feels that the outcome of the unfortunate European conditions will be the added prestige to American-made goods, and the practical disarmament of Europe. At the close of his address a rising vote of thanks was tendered him, while the new Edison Concert Band of Philadelphia, under the leadership of J. G. Johnson, played "America."

Preceding the evening's address, a vaudeville performance was offered by the Entertainment Committee under the chairmanship of F. J. Kuhn. A letter from Thomas A. Edison was read in which he granted permission to name the Section's new band after him. At the close of the meeting a buffet lunch was served. The attendance at this meeting was approximately 500.

Electric Club of Chicago.

S. B. Komaiko recited his experiences in Russia at the meeting of the Electric Club of Chicago, on December 3. Mr. Komaiko, who is a native of Russia, was banished from the country because of his political activities. He spoke of the iron rule of the czar and the hardships of the peasants.

The election of officers which took place at this meeting resulted as follows:

President, W. R. Pinckard.
Vice-president, W. D. Ray.
Secretary, O. H. Caldwell.
Treasurer, A. B. Hatch.

Board of Managers, W. E. G. Peirce, R. I. Phillips, P. B. Woodworth, A. L. Eustice and Ray Palmer.

Following an address by President Bone, the Club voted to expend an amount not to exceed $500 for charitable purposes.

Engineers Inspect New York Power Station.

A number of delegates from the convention of the American Society of Mechanical Engineers, held in New York City, December 1 to 4, visited the new generating station of The United Electric Light & Power Company, 201st Street and Harlem River. This station, recently completed, is one of the largest in the world and at the present time is provided with every modern method for supplying the requirements for electrical energy in the Borough of Manhattan. Delegates from all parts of the country, prominent in their profession, inspected the great plant thoroughly and were impressed with its novel features.

Over one hundred members were conveyed through the principal thoroughfares on sight-seeing busses.

Kilowatt Club Meeting.

The annual election of the Kilowatt Club was held in the Johnston Building, Brooklyn, N. Y., November 30, 1914. The retiring president, Mr. Babcock, introduced the speaker of the evening, C. H. Stevens, power engineer of the Brooklyn Edison Company. He gave a very interesting talk on "Power Possibilities of Brooklyn." This talk was based on a thorough census of the entire city on all power installations above 25 horsepower, was carefully prepared and well delivered.

Mr. Seelman spoke interestingly on the progress of the new wiring plan inaugurated by the Brooklyn Edison Company and the result was that a Committee on Fixtures consisting of E. J. H. Thiemer, J. E. Weismandel, W. H. Wells, H. N. Schwartz, and George Weiderman was appointed in connection with the new wiring plan.

The Nominating Committee then reported, and the following were unanimously elected: President, Louis Kalischer; vice-president, Charles Brown; secretary and treasurer, G. J. Leibman; members of the Executive Committee, Oswald Quist; M. R. Rodriguez, W. C. Sloan, W. T. Fairbairn, and S. D. Sprong.

After adjournment 170 of the members sat down to a collation and listened to an excellent vaudeville bill prepared by the chairman of the Entertainment Committee, Benjamin Rush.

California Jovian Meeting.

The regular meeting of the Jovian Electrical League of Southern California was held on December 2 at Los Angeles. W. L. Boxall was chairman of the day, and the program arranged by him was very interesting. J. Witcomb Brougher, pastor of Temple Baptist Church, was the principal speaker, and explained how he conducted what he considered "The Biggest Business in the World." John Bentzien, associate pastor, talked on "Religion in Business and Business in Religion." A. Ray Petty, director of work for men and boys, took as his subject "Pep, or the Power That Keeps You on the Job."

Chicago Section, Electric Vehicle Association.

The meeting of the Chicago Section of the Electric Vehicle Association of America on December 8 was devoted to an informal discussion of methods for boosting commercial electric vehicle sales in Chicago. J. W. McDowell, chairman of the Section, in introducing the subject, thought that impetus could be given the commercial vehicle industry by having truck salesmen exchange the names of electric vehicle prospects with each other, so that a potential purchaser could have the arguments presented from different sources. In justification of this action Mr. McDowell commented on the handicap under which the electric salesmen are working, because of the fact that the gasoline field is represented by about 200 salesmen, while there are less than ten in the electric end.

Mr. McDowell also suggested that the manufacturers of electric commercial cars represented locally could cooperate with the Commonwealth Edison Company in a newspaper advertising campaign similar to that carried on in the passenger-car field. Moving picture films featuring electric vehicles were also referred to as an excellent advertising medium.

C. A. Street, G. A. Freeman, George H. Jones, and George B. Foster discussed the topics presented by Mr. McDowell, the consensus of opinion being that the exchanging of prospects' names among salesmen would serve to impress the purchaser to a greater extent than if solicited by only one man as representing the electrics, as compared with 20 or 25 gasoline truck salesmen. Some discussion was had relative to the available data on electric trucks, and it was generally conceded that specific information relative to the operation of a single vehicle was of greater value than average data relative to vehicles in certain class of service. It was also brought out that much of the success in interesting the small user in electric vehicles depended upon the providing of adequate garage facilities for taking care of such vehicles.

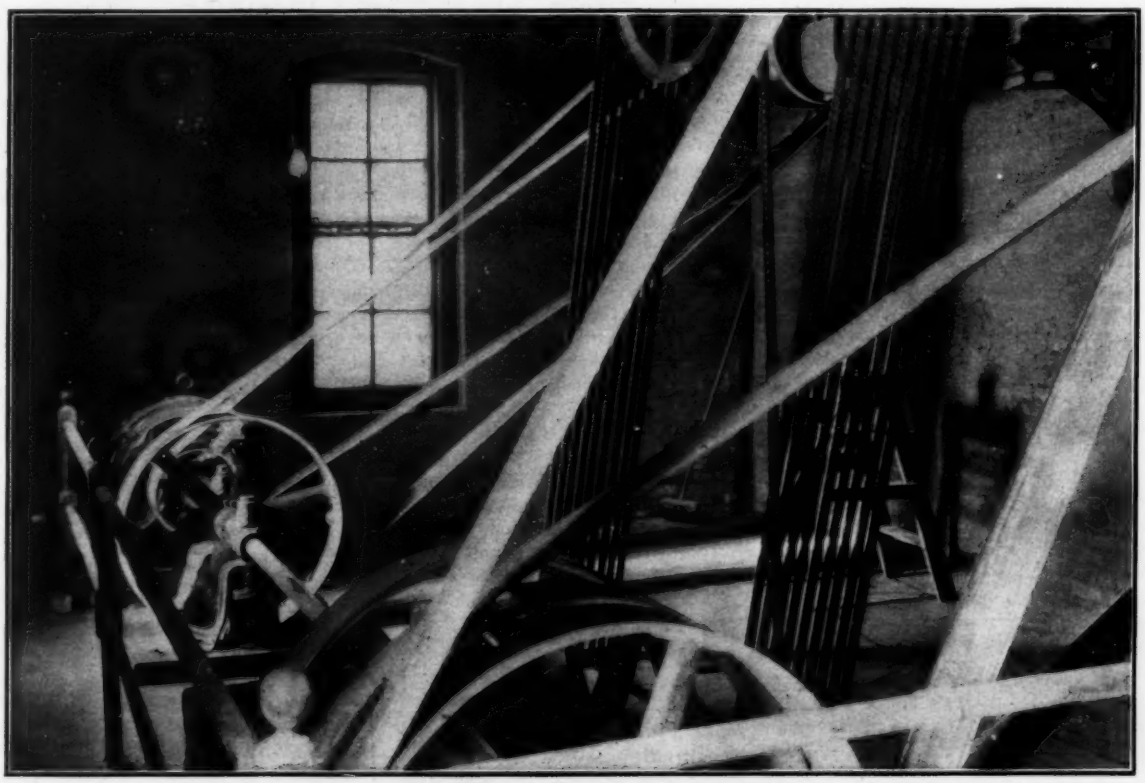
Chicago Jovian League.

No definite program was arranged for the meeting of the Chicago Jovian League on December 7, the session being devoted to a general discussion of Jovian topics. The question of changing the meeting day was brought up and a motion made to obtain a postal ballot. It was also decided to ask members of the League for contributions to a Christmas charity fund. The secretary, G. W. Cummings, 613 City Hall, will receive all subscriptions.

Electricity in Malting Houses.

This article comments on the relative merits of isolated-plant and central-station service and points out the advantages of the latter for operation in malting houses when continuity of service is the most important requisite. Detailed data are given on the motor installation in a modern plant in Minneapolis.

The past 15 years have witnessed an extraordinary growth in the popularity of central-station service, or the use of purchased energy. The explanation is not difficult to find. The increased use of purchased energy in place of home-made energy has been the logical result of the satisfactory experience of those enterprises who, through reliable and fair dealing electric service companies, have been users of service of this character. The best friends any electric service company can have are those who have gained their experience from the use of purchased energy, and if the experience so gained is satisfactory, the electric service company is at once assured of the greatest asset it can have—the friendliness of the community in which it operates.



Dry-Kiln Machinery in Minneapolis Malting House, Driven by 40-Horsepower Motor.

A few years ago, power users who bought their power service were not nearly as numerous as they are today. The many large power companies throughout the country had among their customers a very few of the larger consumers, an altogether too large percentage of power users preferring to manufacture their own current. Finally, however, some of the large consumers having misgivings, and perhaps realizing that they were paying the price of their self-assurance, ventured to buy some power from the local central station, just to see what they would do. They have since found that their misgivings were unwarranted. They have found that the electric companies are among the foremost public servants to adopt as their guide the idea of service; that it is to the central station's own advantage to supply power service of the best quality and at the lowest possible rates. They have found that just as soon as they have decided to use purchased energy, at that moment the entire organization of the power company enters their employ. Moreover, they have found that to invest money in expensive plant equipment and have the continuous expense and trouble connected with fuel and to use floor space that could be made productive in their own business is not the policy that will yield them the best returns on this money. From the results obtained, it is not to be wondered at that these consumers of purchased energy have become enthusiastic advocates of central-station service.

The business of supplying electric light and power is an extremely complicated problem, requiring a high degree of knowledge and experience in almost every branch of human endeavor. The inexperienced, the venturesome, the speculator, or those who are willing to take chances or who refuse to invest money in labor and money-saving methods on the ground that they are not in a position to pay are doomed to failure, and sooner or later, those who enter into the business of manufacturing a produce absolutely foreign to their real issue will suffer through unsound judgment. As one writer expressed it, "Failure is written somewhere in the history of every isolated plant."

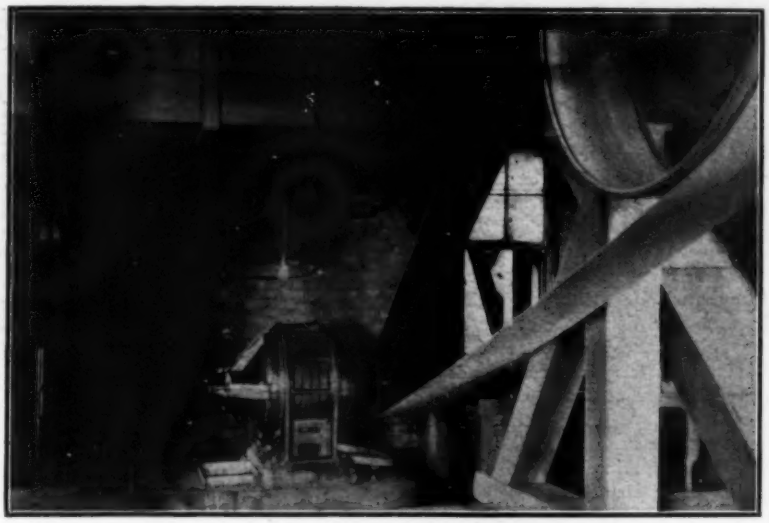
It is only through a long and successful experience that a central station can accumulate knowledge which

enables it to produce a service of a reliability and continuity-factor which is not open to question.

In dealing with an old or prospective consumer, it should be pointed out and they should be made to appreciate the far reaching steps which the modern up-to-date supply company is taking to protect their patrons. The progressive central stations of today assure themselves that the funds they have invested in their plants shall always remain safe and will produce the largest return possible, and for this reason, keep in touch and receive voluminous reports from every part of the civilized world. There is not the smallest detail of improvement which will in any way raise the operating efficiency of the plant as a whole that is not adopted by the up-to-date central station.

No isolated plant or large consumer of energy has the time or the facilities to make these investigations, but by purchasing power from the local company, they can have the same benefits at no expense whatever.

In dealing with isolated-plant competition, it might be well to point out that it is often more difficult to save money than it is to make money. The investment of the prospect's money should entail as much thought and care as the earning of it did. The prospect has two avenues for his funds. He can either place his funds into an isolated plant, concerning which he has little information and run the risk of losing it, or he can place his power requirements in the hands of a reliable electric service company and, after consulting with them on every detail of power service, can place his funds in his own business and still have a large, successful organization behind his, whose specialty is the manufacture of light and power, and concerning the safety of which he need never have the slightest doubt. In this way, the money which he would have invested in an isolated plant, a side-line to his regular business, will be put into his own business, increasing his output proportionately, and earning the same rate of return as the rest of his capital. This probably means more to a prospect as a power user than he perhaps realizes.



Fan Supplying Air to Malt Bins Driven by 100-Horsepower Motor.

In connection with the operation of isolated plants, there is another important point which I think has not been brought sufficiently to the front, and that is the inability of the private plant which is not being pushed to its capacity to avail itself of the many advantages to be obtained by the use of the more efficient appliances which have recently been put upon the market. The reason is simply that the introduction of the lesser current-consuming devices, such as nitrogen-filled Mazda lamps, for instance, will cause a reduction in only two of the items of costs, namely fuel and water. It will readily be seen that the operation of a private plant that is not running at capacity load cannot afford to install the most modern and efficient devices as could be done when the power is purchased, for the reason that there is no saving in the fixed charges, such as investment, labor, depreciation, etc., whereas the introduction of these same improvements when current is purchased from the central station results in the lessening of the demand charge and a reduction in the kilowatt-hour consumption. In other words, the operator of an isolated plant is not in a position to take advantage of the many improvements and the increased efficiency of all current-consuming devices unless the isolated plant is operating at capacity load, which by the way, is seldom the case. It should be realized that the above is one of the real reasons why most isolated plants become less efficient and cost more to operate as time goes on, whereas it is a fact that electrical energy from a modern central station is one of the only commodities the price of which to the public has been constantly lowered. The actual saving to be effected in any particular case, of course, depends on many contributing factors, but it can safely be stated that the saving will be five to ten times as great when the energy is purchased as when it is made in a private plant. A little figuring will prove this statement.

Whatever else might be said, the final object of any power salesman is the conversion of kilowatt-hours into dollars and cents. One may theorize

Mustard Cleaners Driven by 7.5-Horsepower Motor.

Main Line Shaft Driven by 60-Horsepower Motor.

all he pleases, but the fact remains that the man who has the highest conversion factor in this connection is the man the central station can afford to hire and can afford to retain. The attitude in this respect of the management of one of the largest water-power properties in the country was very forcibly driven home to the writer quite recently when the general manager politely exclaimed, "Don't talk kilowatts or kilowatt-hours, talk dollars and cents."

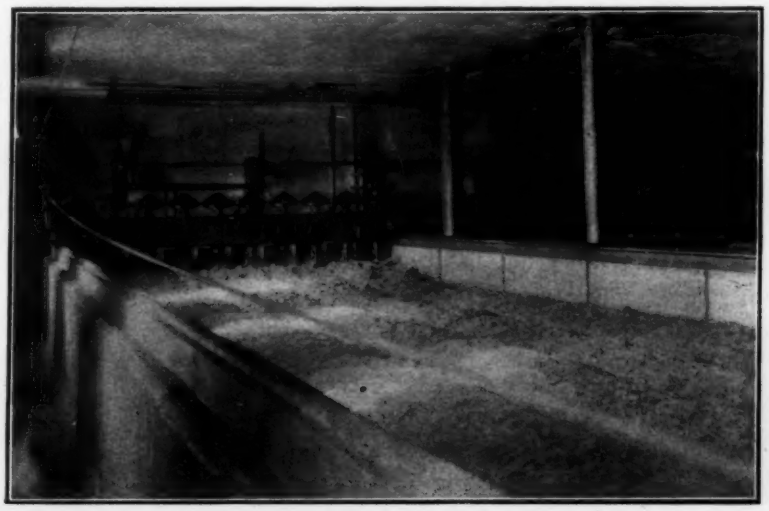
In negotiating power business, the power engineer should always keep foremost in his mind the fundamentals underlying the cost of production and the relation of load-factor to the cost of a kilowatt-hour. The writer has from time to time collected the following quotations on load-factor, etc., and is reproducing them here, as they help considerably in knowing what effect a given class of business will have on the total cost of producing energy at the company's plant, and whether or not such business will be benefitial to the company as a whole.

"Load-factor is the most important item in fixing our manufacturing costs. That the greater the proportion of fixed charges to the total cost, the more marked the effect of load-factor. That with low load-factors, the investment charges must be as small a proportion of the total cost as possible. That high load-factors will permit the use of more costly, higher grade equipment. That the value of a plant where the important manufacturing cost remains virtually fixed, absolutely depends upon the load-factor. The cost of manufacturing a kilowatt-hour being subject to variations of load-factor, may vary within wide limits. That if the commodity be sold at a fixed price, the margin above cost must be ample to cover possible variations. That if this commodity is to be sold in close competition, the price must take load-factor into consideration to be fair to both buyer and seller. That in competition, the possession of a better load-factor than a competitor gives a decided advantage. That the load-factor (effect) is greatest between 20 and 80 per cent. That the lower the load-factor, the more precarious the transaction of sale at a fixed price. That the addition of any business which has a better load-factor than the average is beneficial to the entire output. That the addition of any business which decreases the average load-factor raises the cost of each kilowatt-hour of output. That the commercial forces are absolutely responsible for the load-factor of the system. Load-factor controls revenue; the higher the load-factor, the greater the revenue of capital investment. Good power-factor allows the use of the full rated output of the generators, line and transformers and, consequently, increases the revenue. The diversity-factor controls the station investment. These three factors together, namely: the load-factor, the diversity-factor and the power-factor, absolutely control the earning ability of every dollar invested."

The above introductory paragraphs have been given by way of a preliminary to the interesting question of the introduction of central-station service to the North Star Malting Company of Minneapolis.

In the early part of 1907, the North Star Malting Company began to feel the need of enlarging its plant in order to take care of the increasing demand for its product. Not the least of the important features to be considered in connection with enlargement was the supply of additional power, the source at that time consisting of a 425-boiler-horsepower isolated steam plant. Negotiations were immediately reopened between the malt company and power company, and, although the local company found itself up against as keen competition from private plant salesmen, boiler men, engine men, as though there had been a local competing company, suffice it to say that the local central station secured the business the malting company deciding not only not to purchase any more equipment, but also to shut down its isolated plant, except for heating purposes, and use central-station service for all available purposes.

In the study of the application of central-station power service to malting houses, it is both interesting and important to understand the various chemical changes taking place during steeping, germination, etc., in order to fully realize the value of continuity of



Germinating Tank Showing Malt Turners.

service. For this reason, it is well to mention a little of the theory of malting in connection with the various motor applications.

Only the highest grade barley is used by the North Star Malting Company. After a car of grain is placed on the company's siding, it is pulled to the receiving hopper and there unloaded by a pair of power-driven shovels which are driven from the main shaft on the ground floor, also driving the car puller. This grain is immediately handled by the receiving leg, having a capacity of 2,500 bushels of barley per hour and height of 200 feet. From this leg the grain is dumped into the hopper scales, is weighed and then falls by gravity to the receiving tank known as a garner, which is just above the cleaners. The cleaners remove the coarse impurities before the barley goes to the receiving separator. In the separator, the barley and seeds, the heavier material, fall to the shaker screen, while the light chaff and everything lighter than barley is taken care of by suction fans. Dust collectors are also operated on each of three floors, as described and detailed on the data sheets. From the shaker screen in the receiving separator, the barley next goes to La Prinz graders, which are driven by a 30-horsepower, 440-volt motor, running at 850 revolutions per minute. After grading, the barley is subjected to a second system of cleaners, which recleans the graded barley. These cleaners are also driven by 30-horsepower motors. The barley, now cleaned and graded, first goes to Richardson automatic dumping scales and is then elevated and belt conveyed to the bins. The legs, four in number, for elevating this cleaned and graded barley, are 100 feet high and are driven by 15-horsepower motors. The legs have a capacity of 1,000 bushels each.

The barley is now stored in the bins and ready at any time to be conveyed to the malting house. The bins are 70 by 21 feet, there being 28 of these bins and 18 inner spaces. Each bin has a capacity of 22,000 bushels of barley, while the inner spaces can hold 6,500 bushels. In addition to these bins, the equipment also includes three steel bins of 10,000-bushel capacity each, and six steel bins of 2,000-bushel capacity each, used for the storage of barley in any state.

The cleaned and graded barley is now weighed and conveyed by screw conveyors to steeping cisterns and moistened with water, in order to start the process of germination. The cisterns are made of cast iron with conical bottoms, in order to be self emptying. There are 12 steeping tanks, each having a capacity of 1,250 bushels of barley. About 5,000 bushels of barley is steeped per day. When the barley has been in the steep about 48 to 60 hours, at a temperature of from 50 to 54 degrees Fahrenheit, it begins to germinate. The process of germination is of particular interest from a chemical view, and of great importance to both the malt house and central-station operator when considering uninterrupted service, for a stoppage of current might mean a serious loss to both.

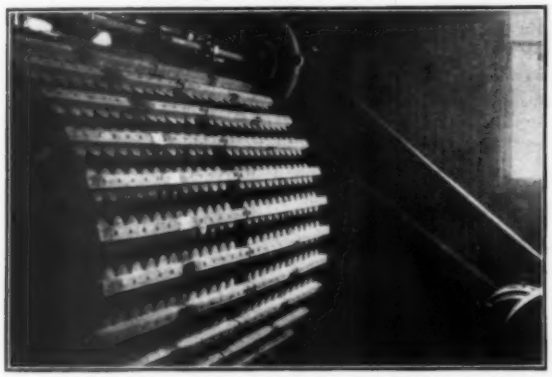
The steeped barley is now allowed to fall, together with the water, through a flexible-steel tube, six inches in diameter, to the germinating beds where the water separates through perforations in the bottom.

The barley is levelled down to a depth of 18 inches to 2 feet, immediately commencing to germinate. The acrospire grows upward under the skin and the radicle (roots) grow downwards. After about seven or eight days, the acrospire will be three-quarters way up the grain, and the roots are to one and a half times the length of the grain. When the barley begins to sprout or grow, small hair-like roots are produced, and heat is generated during growth. The temperature of the compartment is maintained at from 60 to 64 degrees Fahrenheit, the supply of air for which is furnished by two exhaust fans driven by two 85 horsepower, 2,300-volt motors, the air first passing through a system of cold water sprays to clean the air and also to maintain the predetermined temperature. The exhaust fans create a vacuum in the germinating room with the 24 dampers open of 1 to 1.25 inches.

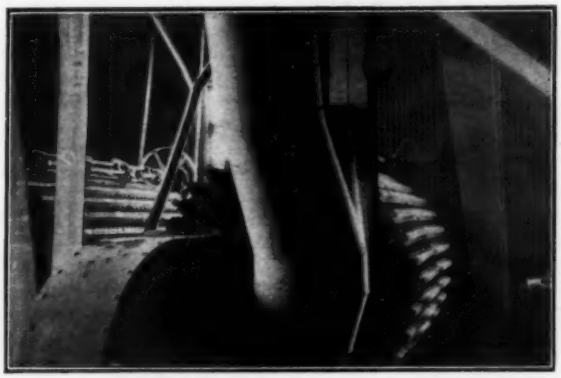
The water for this cleaning system is pumped from two wells, one 450 feet and the other 600 feet deep. A 40-horsepower, 440-volt, vertical motor, direct-connected to an 800-gallon vertical centrifugal pump, supplies the water.

During the whole of the germinating period, which takes seven or eight days, it is necessary to supply air to the germinating barley, in order to insure uniform growth. This is done by automatic malt turners, which move up and down the beds of malt very slowly and thus subject the malt to a uniform supply of air.

The process of germination having been completed, for the purposes intended, we now have a supply of green malt, and it is interesting to review the chemical changes that have so far taken place in the barley grain. After the steeping and during the germinating process, the enzymes, diastase and cystase is developed in considerable quantity in the germ of the grain. The cystase has dissolved the cellulose membrane, which separated the starchy matter of endosperm from the germ, thus enabling the diastase to gradually diffuse throughout the starch in the endosperm, and consequently break down the starch into various sugars, principally maltose. At the same time other enzymes appear in the germ and a succession of complex substances are formed by the developing germ. During this period the germ breathes, absorbs oxygen, throws out carbondioxide and water and generates heat. The cystase enzyme has loosened the cell membranes by its cellulose-dissolving action and the barley grain is thus in a softened condition.



Dust Collector Driven by Five-Horsepower Motor.



Exhaust Fan Driven by 30-Horsepower Motor.

The malt is now ready to be conveyed to the drying kilns. The way this is accomplished can be understood quite clearly by referring to the illustration of the germinating bed which shows clearly the removable metal retainer behind the automatic malt turner. When the malt is fully germinated, the metal retainer is removed from the end of the compartment, thus allowing the malt to be forced out of the compartment, from which it falls onto a conveyor belt and is carried to a receiving leg having a capacity of 5,000 bushels of malt in four hours. It then goes to a screw conveyor which carries it to the dry kilns.

The process of drying the malt takes place in three stages, and in compartments very similar to the germinating beds, one stage of kilns being on each of three floors. The green malt is evenly spread over the kiln floor to a depth of 12 to 18 inches, and is uniformly turned by the automatic malt turners, so as to allow the heat from the furnace to come in contact evenly with the whole of the malt. The heat for drying the malt is obtained by means of a furnace, a good anthracite coal being used, and rises up through the kilns in series. The wet malt is first placed in the upper kiln, and receives the hot air at a temperature of about 85 degrees Fahrenheit. This partially dried malt is then placed in the second dry kiln on the floor below, is further dried, and finally is placed in the lower kiln and dried at a temperature of 165 degrees Fahrenheit.

Throughout the whole process of drying, the malt is thoroughly turned, obviating the risk of getting unevenly colored malts.

The air for this drying process is supplied by two large fans, each capable of furnishing 85,000 cubic feet of air per minute, each fan being belt connected to a 100-horsepower, 2,300-volt motor. These motors run 24 hours a day, 7 days a week.

The malt, being completely dried, is allowed to cool, and is conveyed back to the elevator by conveyors driven by a 7.5-horsepower motor. It now goes through a final cleaning, is weighed and ready for shipment, the final cleanings consisting of sprouts and husks.

To summarize then, we have the following advantages possessed by the management of the North Star Malting Company since the purchase of central-station energy.

(1) Central-station power is better and gives the management more freedom and thus enables more time to be given to the particular business in general.

(2) Central-station power has been supplied more cheaply than if the company attempted to make its own power.

(3) The North Star Malting Company has grown considerably in the last few years, necessitating many additions to its power equipment. The money that has been spent, by virtue of this expansion, has been markedly less than it would have been had the energy been made instead of purchased. As a result, the company has had more capital to apply to other directions in the business.

It would not do to conclude without saying a word about the present conditions as affecting the power engineer. In Minneapolis we find the present time an excellent opportunity to approach the subject of power. We argue that a good way to make money when sales slump, or when a man is struck by what is termed a "Psychological business depression" is to look at himself as "he" instead of "I" and we suggest that we get together on the power question. If a man's factory output can be increased, or his manufacturing expenses cut only a few per cent, he is suffering a loss which annually runs into a big figure, and, moreover, this loss to him is just as real a loss as a loss of goods or money. Electric power scientifically applied will stop this loss and now is the psychological time to consider such matters for several reasons. In the first place, for economical reasons, no man can tolerate waste. In the second place, the managers and owners of manufacturing establishments have more time, owing to the slackness of business, to look over power questions and see that everything is properly installed and efficiently operated. Thirdly, this is the logical time to consider such questions, for the foresighted and successful manufacturer does not wait for improved conditions before considering improvements that will save money.

Bin Floor Showing 15-Horsepower Motor Driving Conveyor.

Bin Floor Showing 24-Inch Belt Conveyor Motor Driven.

Employees of Louisville Gas and Electric Company Discuss "Safety First."

"Safety First" was given the attention of the employees' meeting of the Louisville Gas and Electric Company, held in the company's basement meeting room, on November 23, a committee of which A. W. Lee was chairman having the meeting in charge. Numbers of posters calling attention to safety first "Don'ts" were placed about the room, and the whole safety first movement taken up in its general scope.

"Safey first," Mr. Lee said in his remarks, "means primarily taking only the most ordinary precautions. It is a new name for self-preservation." He called attention to a few "Don'ts," such as "Don't smoke on the company's property," "Don't touch fallen wires," "Don't hunt a gas leak with a flame," and "Don't disobey traffic laws." Reviewing the company's accidents of the past year he brought out definitely the need of the safety first movement, showing that 30 per cent of the accidents were due to the victims' own carelessness; about 10 per cent to disobedience of traffic rules; the same proportion to live wires, and about 12 per cent to lack of proper safeguards or to faulty material. Out of the total number of 311 accidents recorded for the year, 117 were due to negligence.

Malting House Data.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for twenty-four hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

North Star Malting Company, Minneapolis, Minn., Malting Business.

Storage capacity, 28 bins of 22,000 bushels each, 18 inner spaces of 6,500 bushels each; also 3 steel bins of 10,000 bushels each and 6 steel bins of 2,000 bushels each. Total storage capacity, 733,000 bushels.

Hours of operation, 8,760 hours per year.

Output of plant in bushels of malt per year, 1,850,000.

Number of men, 45—three shifts.

Total connected horsepower, 845.

Total number of motors installed, 28.

Average kilowatt-hours per month, 169,066.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
June	184,800	October	202,400	February	163,200
July	192,800	November	187,200	March	175,200
August	198,400	December	169,600	April	86,400
September	156,000	January	176,000	May	136,800

Load-factor, 37 per cent. Load-factor based on maximum demand, 56 per cent.

Motor Installation.

The following is a list of the motors with their respective drives. The supply source is three phase, 60 cycle, 2,300 volts. Motors over 40 horsepower in size use 2,300 volts. Motors under 40 horsepower in size use 440 volts, 3 phase.

No.	Horse-power	Speed R. P. M.	Application.
1	60	720	Belted to 90-foot shaft by a 14-inch belt, driving two 24-inch conveyor belts under bins; two cleaners on main floor, each having a capacity of 1,000 bushels per hour; one car puller; unloading shovels; unloading leg 200 feet high, handling 2,500 bushels of barley per hour.
1	15	1,200	Belted to 12-inch exhaust fan to exhaust dust from two cleaners.
1	7.5	840	Belted to six small cleaners to separate barley from oats.
1	15	1,200	Belted to 20-foot line shaft from which are driven four screw conveyors each having capacity of 2,500 bushels per hour.
1	5	1,130	Belted to line shaft having four dust collectors.
1	7.5	900	Belted to 15-foot line shaft (2 hangers) to which is connected two mustard cleaners each having a capacity of 2,500 bushels per hour.
2	30	850	Each belted to 10-foot line shaft from which is run two barley cleaners, each of 1,000 bushels per hour capacity. La Prinz cleaners.
1	15	850	Driving four barley graders, each having capacity of 1,000 bushels per hour.
1	30	850	Belted to 15-foot line shaft to which is connected two 12-inch exhaust fans used in connection with dust collectors.
1	5	1,130	Belted to 25-foot line shaft driving six dust collectors.
1	20	1,200	Belted by 7-inch belt to two legs (double leg) on spout floor; straight drive; each leg having capacity of 2,500 bushels per hour.
1	20	1,200	Back-geared, rope drive (3 ropes) driving small leg, having capacity of 2,000 bushels per hour.
1	20	1,200	Back-geared, rope drive (3 ropes) driving one leg having capacity of 2,500 bushels per hour.
2	15	1,200	On Bin Floor. Each belted to 24-inch conveyor belt by 7-inch belt. Conveyor belt distributes barley to any bin.
1	7.5	1,130	On Bin Floor. Belted to 16-inch conveyor belt by 7-inch belt. Conveyor belt used for distributing barley to various bins.
1	20	1,200	Belted to 25-foot line shaft, driving two cleaners, each having capacity of 1,000 bushels per hour.
1	30	840	On Scale Floor. Connected to line shaft by 11-inch belt, and driving four legs by rope drive (4 ropes). Each leg has capacity of 500 bushels per hour.
1	7.5	850	Connected to line shaft by 11-inch driving two legs by rope drive (4 ropes). Capacity of each leg 1,000 bushels per hour.
1	3	1,200	Located on top floor and driving small passenger elevator.
1	15	850	Driving belt conveyor for conveying green malt from germinating bed to drying beds.
1	85	720	2,300-volt motor driving exhaust fan supplying air to germinating compartments.
1	85	720	Same as preceding item.
2	100	720	Two 2,300-volt motors, each belted to fan having capacity of 85,000 cubic feet of air per minute and supplies air to drying kiln.
1	40	850	Operating machinery for a dozen kilns.
1	40	1,800	Direct-connected to an 800-gallon, two-stage, vertical, contrifugal pump which supplies water for cleaning and cooling air.

Commercial Practice
Management, Rates, New Business

Additional Street Lighting for Lexington.

Conditional upon liberal treatment of the Lexington Utilities Company as to rates for the increased consumption of electricity, the City Commission has approved a plan for lighting the downtown streets of the city which would call for use of 115,200 candlepower of light in that section instead of the 5,500 now supplied. The plan has the support of the Board of Commerce and was worked out by a committee of which F. J. Manley is chairman. It provides for lighting standards, each carrying two 300-watt lamps of the most improved type and each giving approximately 600 candlepower. The business houses will bear a portion of the increased expense.

This plan, if carried out, will result in making the downtown business district of Lexington one of the best lighted districts of any city, irrespective of size, whereas this district now is admittedly very poorly lighted.

New Street Light Contract for Boston.

After several weeks of negotiation, a contract for the electric lighting of the streets of Boston, Mass., has been agreed upon by the Edison Electric Illuminating Company and the city officials. The contract reads for a term of ten years, at the rate of $87.53 for each 6.6-ampere magnetite arc lamp, this price subject to arbitration as to its fairness by the Massachusetts Gas and Electric Light Commissioners upon the acceptance of the contract by the City Council, and also at the expiration of five years from that time. The Commission may take into consideration depreciation and interest on the investment in determining fairness.

The city of Boston is to be allowed 75 per cent of any saving that may result from the decreased cost of carrying out the contract. Any disagreement between the city and the company that may arise between the periods of arbitration shall be judged by a special board to consist of one member chosen by the city, one by the company and the third by the other two.

The city may at any time employ an expert to test the current, and if found deficient in two tests made during one hour, the company shall pay the cost of the test.

The company shall submit to the Commissioner of Public Works a yearly statement of the cost to the company of carrying out the contract.

In view of the improvements constantly being made in electric lighting, the contract requires that the company shall install improved lamps on demand, providing they will not cost more than the lights in operation at the beginning of the term of contract.

There are about 4,000 6.6-ampere magnetite arc lamps now in operation. The five-year contract under which they have been operated expired last spring. The rate under that contract was $103.54 per lamp per year.

The question of the new contract's life was under discussion for some time. The city council desired a five-year contract, opposing a draft submitted in September by which the contract proposed was to run for ten years. The result has been a compromise on a 10-year contract, with arbitration after five years.

A public hearing will be held by the city council December 1, at which arguments as to the terms of the contract will be heard.

Electrical Requirements at San Diego Exposition.

In order to serve the electrical demands of the Panama-California Exposition the San Diego Consolidated Gas & Electric Company is installing a new 4,000-kilowatt steam-turbine unit under the supervision of the engineering department of H. M. Byllesby & Company. There is also being installed three additional transformers of 1,000-kilowatt capacity each. The new unit will be ready for service December 15, although the Fair does not open until New Year's eve. The hour of opening means that electricity will play a very important part in the event, and the electric company is taking every precaution to have everything in readiness for perfect service. The electrical requirements of the exposition, including both power and lighting, will total about 2,500 kilowatts, or more than 3,000 horsepower. The service will be performed exclusively by the San Diego central station.

Payment for Special Street Lighting.

Methods of arranging for payment of first costs and of operating expenses of special street-lighting installations, such as have become customary for business blocks, vary very widely in different communities. The following compilations, made in connection with a campaign in Sandusky, O., may be useful to others contemplating similar installations. It indicates, for each city mentioned, upon whom the burden of expense has fallen:

Akron, O.—All cost of white way lighting assessed against owners, who also pay for current.

Aberdeen, S. D.—Installation paid for by property owners, who also pay for current.

Atlanta, Ga.—Installation by property owners and tenants; current paid for by the city.

Aurora, Ill.—Merchants assessed $20.90 for installation, city furnishes current.

Buffalo, N. Y.—Business men and company installed system; city pays for current.

Cheyenne, Wyo.—Merchants pay for installation and current.

Chicago, Ill.—Company installed, merchants pay for current and rental.

Dayton, O.—Lighting company pays for installation, city for one-eighth of current, owners and tenants for seven-eighths.

Des Moines, Iowa.—Property owners installed system, tenants pay for current.

Duluth, Minn.—Property owners pay for system and current.

Fort Dodge, Iowa.—Property owners pay four-sevenths, tenants three-sevenths.

Gary, Ind.—Property owners pay for installation, city furnishes current.

Great Falls, Mont.—Property owners pay for installation and current.

Los Angeles, Cal.—Property owners pay for installation and seven-eighths of current, city paying one-eighth.

Minneapolis, Minn.—Property owners pay for installation, city furnishes current.

Mishawaka, Ind.—Merchants pay for current.

Toledo, O.—Cost of all lighting, including residence, assessed on property owners.

Superior, Wis.—Property owners pay for installation, tenants pay 7.2 cents per front foot per month.

Syracuse, N. Y.—Merchants pay for installation and pay 15 cents per front foot per month for current.

Wausau, Wis.—Merchants pay for installation, city for current.

Columbus, O.—Merchants pay for installation, municipal plant furnishes current.

Kokomo, Ind.—Merchants pay for installation, city for current.

Oakland, Cal.—Property owners pay for installation, city for current.

Macon, Ga.—Merchants pay for installation and current.

Rate Reduction in Idaho Town.

Schedules of rates to be charged for electric light, heat and power service were filed with the public utilities commission recently by the Swan Creek Electric Company of St. Charles, Idaho. These rates are for the town of Fish Haven, Idaho, only. For lighting and general household purposes the charge will be 10 cents per kilowatt-hour. The flat rate will be two 16-candlepower lights for $1.00 a month.

Power charges by this company will be six cents a month for the first 500 kilowatt-hours used, for the next 9,400 kilowatt-hours three cents, and for any additional consumption two cents per kilowatt-hour.

The schedule will become effective January 1, 1915. The company applied at one time for a certificate of public necessity to operate in St. Charles, but the commission found that the Utah Power & Light Company was serving that territory and refused the application.

Duluth-Edison and City Council in Wrangle.

A serious disagreement has arisen between the Duluth-Edison Electric Company and the city council as to what constitutes a reasonable lighting rate. The council, at the suggestion of the Commissioner of Finance, F. J. Voss, approved a four-cent maximum rate; to which A. W. Hartman, president of the Duluth-Edison Electric Company, has replied with a statement and tables of statistics to show that a six-cent rate, which the company offers, is the lowest it can offer without being forced into bankruptcy. According to the tables worked out to show the costs and profits of the company last year, a loss of $180,336.36 would have been suffered had the city's proposed rate been effective. Another table indicates that, had the rate the company is now offering been in effect, the net earnings would have been reduced by $79,697.32. The reduction the company is willing to make, it is pointed out, is justified only on the expectation that an increase in business will partially compensate for it.

It is further pointed out that if the city's proposed schedule had been effective the company would not have been able to make additions or improvements, nor would it have been able to pay dividends on stock or make allowance for depreciation. The reduction asked by the city varies from 32.29 per cent to 50 per cent for the different kinds of service. The discrepancy of opinion in what should constitute a reasonable lighting rate, the electric company holds, is due to an inadequate valuation by the city of the company's plant.

Central-Station Christmas Tree Boosts Sales.

A Christmas tree, gaily decorated and heavily hung with electric irons,

Christmas Tree in Louisville Display Room.

toasters, curlers, vacuum cleaners and other small electrical appliances, not to mention ropes of electric lights for decorating trees, is attracting a great deal of attention in the display room of the offices of the Louisville (Ky.) Gas & Electric Company. The tree is in the center of the big display of all manner of electrical appliances in cases and supplements a campaign being conducted by the Louisville Gas & Electric Company in co-operation with five of the electrical supply houses in Louisville.

This campaign is especially directed to selling electrical irons and electric toasters and more than 20,000 letters have been mailed out to the electrical subscribers of the company, each containing a letter from one of the electrical houses participating in the campaign and a coupon which if presented before Christmas Day entitles the purchaser to $1 off the purchase price on any $3.50 iron or any $3.50 toaster. The five houses which are devoted exclusively to the electrical supply business are named on this coupon. They are the Childers & Waters Company, the Home Electric Company, the James Clark, Jr., Company, the H. C. Tafel Electric Company and the Harry I. Wood Company. Since the display has been put on in the electric company show rooms and since these coupons have been mailed out there has been a run on the supply of irons and toasters in Louisville.

Boston Company Encourages Employees to Make Constructive Suggestions.

The Boston Edison Company has adopted an excellent plan by which the interest of employees is being stimulated to make suggestions for the betterment of service and to report on defects or deficiencies. A small, neat, leather-bound pocket note book is given to each employee, each book consisting of about 100 leaves of fairly heavy writing paper, perforated so as to be easily torn out. These leaves are printed with a number, running through the book, and on the pages the employees are asked to jot down suggestions on the introduction of appliances, any pole or insulation defect that may be noted, or any other useful thought they may have as to improving the usefulness of the Edison Company in its relation to the community. These leaves are to be turned in to the head of the appliance department, and the ideas utilized by the department to which they may pertain, so far as the ideas are of value.

In a typewritten letter sent to each employee with the note-book, the superintendent of advertising says: "There is a good deal more than 'juice' in the service we give our customers. It includes courtesy and intelligent attention. On the pages of our Lead Books, pass along these inquiries and suggestions to the men who are responsible for the handling of these things."

Big Holiday Sales of Electrical Appliances at Byllesby Properties.

Reports of November sales in the holiday electrical appliance campaign at the Byllesby properties indicate that from two to three times the number of devices will be given away as Christmas presents than ever before. All properties report an unusually brisk demand, not only for electric flat irons and toasters, but for many other articles consuming electricity.

Electric Vehicle Data

Selling the Electric Vehicle.

The arguments in favor of using the electric vehicle have been published and quoted so often that it would appear that no new ideas can be advanced on the subject, and yet the fundamental considerations are often overlooked by a salesman in his desire to impress a prospective purchaser. In this connection attention is called to the subjoined remarks of W. P. Kennedy, at the recent convention of the Electric Vehicle Association of America, which emphasize and reiterate in a convincing manner some of the facts that are often overlooked.

One of the greatest incentives to the favorable consideration of electric vehicle employment will be to direct attention to the present stability of electric-vehicle equipment as compared with any other type of motor vehicle. The electric machine has been evolved under the most rigorous and exacting service during the past 15 years, and as a successful device in quantity installation for commercial purposes, has commanded the endorsement and investment of the merchant community to a greater extent than any other kind of motor vehicle.

Large installations of such vehicles in all the principal cities of the country and their economical performances, have instilled such confidence among those conversant with their capabilities as to put them in the class with all other staple industrial apparatus. Some of the underlying considerations which have developed this confidence are as follows:

The principles of their design are founded on those developed in the street-railway industry, the critical component parts of their equipment being made in the same large electrical apparatus manufacturing establishments.

Their reliability and simplicity are on a par with that of the street car, and they have many superior features contributing to a wider range of usefulness, without the necessity of any higher grade of operator than that which prevails in street-railway service.

They are made up of the least number of moving parts of any type of motor vehicle, so designed and applied as to be practically fool-proof.

Their performance is so predetermined that the operator has little to do but to apply power and steer the machine.

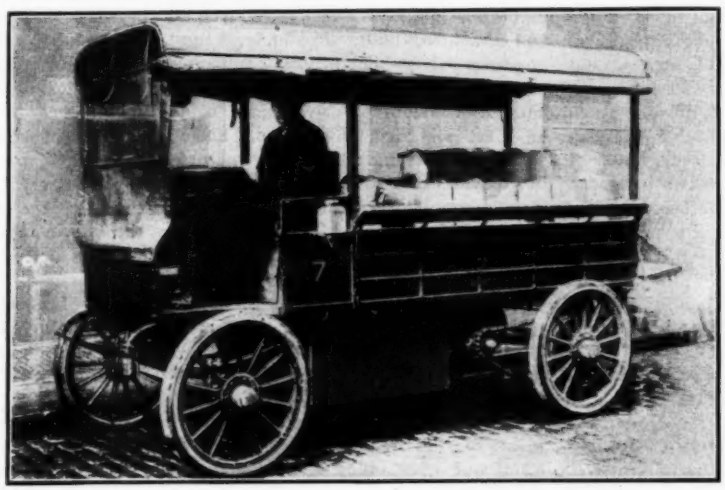
The working equipment has been so standardized that the renewable wearing parts are readily replaceable at low cost, and are available in all the principal centers of the country.

Wherever they have been installed within the field of rational application they have not only remained, but by the influence of their economy have forced an increase in their number.

The following figures have been compiled to illustrate the value of the investments made to date in electric commercial vehicles, in a comparatively few lines of business:

The department stores lead with a total investment in electrics of $5,627,000; breweries are second, with an investment of $5,350,000, and other industries follow in the order named: Public service companies, $3,671,000; express and transfer companies, $3,010,000; wholesale merchants and manufacturers, $2,088,000; packing-house organizations, $600,000; and United States Government service $435,000.

The operating data shown on this page, which were contributed by the General Electric Company, Philadelphia, Pa., emphasize the economy of the electric truck. In referring to the low monthly operating cost the company states, "we have found that the secret of successful and economical operation is daily, weekly and monthly inspection by a competent mechanic."



GENERAL.

Name of Company—General Electric Company, Philadelphia.

Business—Electrical Machinery and Supplies.

Capacity of Vehicle—2,000 Lbs.
Approximate Price—$2,500.
Make of Tires—Goodrich.
Tires—Solid (demountable rim).
Make of Battery—Philadelphia
Date of Purchase—May, 1910.
Make of Vehicle—General Vehicle Company.
Size of Tires—34x3½ Inches.
Type of Cells—Lead Plate (thin).
Number of Cells—44.

OPERATING DATA.

Average Daily Mileage—35.
Daily Hours in Use—10.
Kilowatt-hours per Month—500.
Cost of Electric Power per Month—$15.
Cost of Storage and Washing per Month—$10 (washing only).
Days in Service, per Month—25.
Driver's Salary per Month—$65.
Cost of Repairs and Renewals for Twelve Months—Battery, $300; Tires, $150; Motor, $25; Other, $100 (includes inspection).

TOTAL AVERAGE MONTHLY OPERATING COST—$165 (includes interest on investment and depreciation and insurance charges).

Electrical Construction

Improvements in Fire-Alarm System of New York City.

At a meeting of the Municipal Engineers of the City of New York, held in that community on October 28, Putnam A. Bates, chief of the Bureau of Fire Alarm Telegraph, read a paper entitled "The Fire-Alarm Systems of the City of New York." This paper reviewed the history of the fire-alarm equipment of the city, beginning with the year 1865, when watch towers were used for observing the breaking out of any blaze; communication was had by telegraph with the central fire office. In 1870 the present fire-alarm system was installed, with 578 street alarm boxes, at a cost of $450,000. This operated very satisfactorily until the year 1881. On January 31 of that year occurred an extraordinary sleet storm, which rendered almost the entire fire-alarm circuits inoperative, so that but six of the 570 boxes were in communication with the central office. Much agitation in favor of placing the circuits underground resulted, but not much was done. In 1888 and in March of 1914 other serious storms again brought the matter to the public attention. The storm of last March almost completely crippled the system, pulling down wires not only in the outlying boroughs but also in the borough of Manhattan itself.

As early as 1905 the matter of complete rehabilitation of the fire-alarm system was agitated by the New York Board of Fire Underwriters. In 1907 plans and specifications were prepared for a modern system for Manhattan Island. For many years nothing was done, however, except spasmodically here and there. Contracts have been let for placing considerable sections of the service cables underground. Much of the money appropriated, however, had to be diverted to the maintenance of the old system. Mr. Bates described the equipment in use, and showed that there was a great variety, both in length of the box circuits and in the number of boxes connected to them. The average throughout the city is about 25 boxes per circuit; in some sections of Brooklyn, however, over 100 boxes are placed on one line. All of the street box circuits are of the closed-circuit type fed from storage batteries located at the central offices. There are three of the latter; one in Manhattan, another in the Bronx, and a third in Brooklyn; in each case these are located in public parks. In these offices center not only the box circuits, but also the station circuits connecting the various fire-department stations, city buildings and high-pressure pumping stations.

The present municipal administration has taken up the rehabilitation of the system in earnest. Rigid specifications for the highest type of equipment have been drawn up. New central office equipment will be provided in three boroughs. The most radical feature of the improvement is in placing all circuits underground. Fortunately arrangements have been made by which fire-alarm cables can be placed in the numerous subways already constructed and now being built. The underground conduits of public utility companies may also be used in many places. Although considerable fire-alarm cable has been installed underground, and in some cases strung along the structures of elevated railways, an extremely large amount of aerial line must still be placed underground. This is particularly true in the outlying boroughs. Many of the circuits are poorly located, so that by complete reconstruction it will be possible to arrange them more advantageously with considerable saving in wire. At the present time the aggregate of all underground and overhead circuits in the fire-alarm system in all of the five boroughs is between 3,500 and 4,000 miles. The placing of the lines underground will not only eliminate the possibility from serious interruptions of aerial lines, but will very greatly reduce the annual cost of maintenance. The total expenditure involved in the complete rehabilitation is about $5,000,000. The immediate expenditure contemplated aggregates about $2,000,000. For the present some aerial circuits will be left in outlying boroughs, but in Manhattan and in the more congested portions of the other boroughs underground cables will be installed directly, this work to continue as fast as possible until the entire circuits are placed underground.

Many cities in the vicinity of Canton, China, are considering the installation of electric lighting plants.

Sheffield City and Electrical Contractors.

The City of Sheffield, one of the principal centers in which English electrical contractors have fought in recent years for their rights, against municipal electric supply undertakings, has again been the scene of conflict over the same question. On the previous occasion the matter took the form of litigation and finally the municipality lost, and new legislation was passed. When this new legislation was before the House of Lords terms of settlement were arrived at, and lately the City representatives have been putting before the contractors certain proposals respecting the sale of electric fittings which the contractors say are in direct opposition to the terms of the aforesaid settlement. No agreement having been reached between the parties, a new scheme has now been drawn up for the future working of the motor and installation department along the following lines:

(1) A showroom or rooms to be maintained for the exhibition of electrical fittings, including such electric light fittings as the central station can only sell through a contractor carrying on his business independently of the central station.

(2) The following to be the method of selling electric light fittings through contractors carrying on their business independently of the central station:

(*a*) A list of such electrical contractors as are willing to co-operate with the central station in the sale of electric light fittings to be prepared and maintained;

(*b*) The central-station solicitors and showroom attendants to be supplied with this list and authorized to inform customers that the central station will sell to them through any of such contractors such electric light fittings as they may require;

(*c*) A purchaser having selected fittings shall declare the name of the contractor upon the list through whom he wishes the fittings to be sold to him, and thereupon the central station shall sell the fittings to the purchaser through such contractor;

(*d*) The central station shall notify the contractor selected by the purchaser that the purchaser wishes to purchase through him the fittings specified, and request him to undertake the transaction, and on his doing so the sale shall be carried out

through such contractor who shall become liable to the central station for the price of the fittings and shall receive payment for the same from the purchaser;

(*e*) the central station shall receive as payment for the services rendered on the sale of such fittings a sum equal to 20 per cent of the amount charged by the contractor to customers in the case of customers introduced by the central station, and a sum equal to 10 per cent of the amount charged in the case of customers not so introduced, or such other sum or sums as may from time to time be mutually agreed upon;

(*f*) the fittings shall be delivered to the purchaser by the central station or the contractor through whom they have been sold, as may be mutually arranged between them.

(3) An invitation to be given to all electrical contractors in the city to place their names upon the list of contractors maintained by the central station.

The show room is to be open to contractors and their customers and full assistance as to electric light fittings to be given by the central station and its officials to the contractors and their customers free of charge, and without being requested or expected to purchase such fittings from the central station. A bonus is to be paid to the contractors on the official list, at an agreed rate, for lighting, heating or power plant installed in consumers' premises.

Comparative Insulation Requirements.

In the last issue a comparison was given of the wiring rules in force in the United States, Germany and Great Britain. In addition, two diagrams were given, showing the allowable currents for conductors of different sizes, and the required weight of conduit in a number of other European countries, as well as these three. This information was compiled for the Committee of the National Electric Light Association on Wiring of Existing Buildings by Hugo Eisenmenger.

The requirements for insulation resistance in indoor work in the United

COMPARATIVE TABLE ON REQUIREMENTS OF INSULATION RESISTANCE IN ORDINARY DRY INDOOR INSTALLATIONS (IN OHMS)
(Resistances to be measured beginning from and after distributing board)

	United States	Germany	England	Austria	Italy	Switzerland	Sweden	Russia
Paragraph of the Regulations	88	5	121,122	104	16	136	14	4
Voltage at which measurements of insulation resistance must be made..	.....	If possible, with operating pressure, at least with 100 volts.	Pressure not less than the intended working pressure.	If possible, with operating pressure, at least with 100 volts.	.....	Direct current of at least 100 volts.	Operating voltage; if not possible, at least 50 volts.	.....
Formula ..... I= max. (effective) current, E=max. (effective) voltage, N=number of lamps, n=number of lamp outlets (not counting wall-switch outlets).	I= 5 amperes, $\frac{4,000,000}{E}$ 10 amperes, $\frac{2,000,000}{E}$ 25 amperes, $\frac{800,000}{E}$ etc. If fixtures are connected, one-half of the above values.	R=1000 E between any two fuses or in the run after the last fuse.	$R=\frac{30,000,000}{n}$ to earth previously to erection of fixtures. $R=\frac{25,000,000}{n}$ between conductors with fixtures in place.	R=5000 E/I in every branch and besides R=1000 E in every branch.	R=1000 E between any two fuses or in the run after the last fuse.	R=1000 E between any two fuses or in the run after the last fuse.	$\frac{1,000,000}{N}$ and besides for every main branch: $\frac{10,000+1,000,000}{N}$	No definite figures
Insulation to be measured to ground or between wires	Both	To ground; but regulations are made in case insulation between conductors is measured also.	Both. See above.	Both.	Both.	Both.	To ground.	.....
Lamp sockets, electroliers, etc., connected or not..	See above.	When measuring between conductors fixtures must be connected.	See above.	When measuring between conductors fixtures must be connected.	When measuring between conductors fixtures must be connected.	When measuring between conductors fixtures must be connected.	Not stated.	.....

EXAMPLES (110 VOLTS)
(Insulation resistances after the last fuses, in ohms)

Number of			United States	Germany	England	Austria	Italy	Switzerland	Sweden	Russia
40-Watt Lamps N	Lamp Outlets n	Circuits								
5	5	1	*a*) 4,000,000 *b*) 2,000,000	110,000	*c*) 6,000,000 *d*) 5,000,000	302,000	110,000	110,000	200,000	No definite figures
10	8	1	*a*) 4,000,000 *b*) 2,000,000	110,000	*c*) 3,750,000 *d*) 3,125,000	151,000	110,000	110,000	100,000	No definite figures
20	15	2	*a*) 2,000,000 *b*) 1,000,000	55,000	*c*) 2,000,000 *d*) 1,667,000	75,500	55,000	55,000	50,000	No definite figures
30	25	2	*a*) 800,000 *b*) 400,000	55,000	*c*) 1,200,000 *d*) 1,000,000	55,000	55,000	55,000	33,300	No definite figures
30	25	3	*a*) 800,000 *b*) 400,000	36,700	*c*) 1,200,000 *d*) 1,000,000	36,700	36,700	36,700	33,300	No definite figures
60	48	8	*a*) 800,000 *b*) 400,000	13,750	*c*) 625,000 *d*) 521,000	25,200	13,750	13,750	16,670	No definite figures

a) With fixtures disconnected. *b*) With fixtures connected. *c*) To earth, previously to erection of fixtures. *d*) Between conductors with fixtures in place.

States, Germany, England, Austria, Italy, Switzerland, Sweden and Russia are given in the accompanying tables, which were prepared by Mr. Eisenmenger in conjunction with the other comparisons. It will be seen that the requirements in the United States are in general higher than in the European countries, although in certain instances the insulation resistance required in England is somewhat higher.

Wiring in Violation of the Code.

At the meeting of the Committee on Wiring of Existing Buildings of the National Electric Light Association, which was held in Boston on September 30, the committee decided to publish a notice desiring central stations, contractors, and others to advise it regarding any districts in which rules are being habitually disregarded without causing fire or other loss. This notice was published in the *Bulletin* of the N. E. L. A. and brought forth the following response, which was sent to the chairman, R. S. Hale, by the manager of a central station in the Central West:

On page 582 of the N. E. L. A. *Bulletin* of October, 1914, it is stated that your committee wishes data as to towns where the rules have been habitually disregarded without causing fire. This is such a town, the facts being as follows.

The population is about 2,000. The plant has been installed about 20 years. The number of customers has slowly grown, the number when the present management took charge being about 230. The current is 110-volt, 60-cycle, alternating. Preceding managements did very bad wiring indeed. It was common to use No. 12 weatherproof wire in concealed work, the joints being bare, and unsoldered. In unfinished attics the wires were simply laid loosely across the joists, while between ceilings and floors the joists were notched slightly and the wires laid together in the notches. All lights in any one building were usually placed on one circuit, and protected by bare wire fuses, which in many cases protected only one side of the circuit. Loom had never been used here at all. For exposed work (and sometimes concealed) it was very common to use lamp cord attached to the surface by staples.

Despite these extraordinary conditions there has never, so far as we know, been a fire in town chargeable to defective wiring. Nor, so far as we know, has the charge ever been made.

The reason for this immunity may be that the rules are unnecessarily severe in many cases, and also that in so small a town as this there is far less probability of interference with the wiring than there is in larger places. In addition, as the company is the only wiring contractor, as well as the only seller of electrical supplies, it is difficult for any changes to be made without our knowledge. Despite the fact that lightning is not uncommon, and our arrester outfit rather old, we are not troubled in that way, other than by the blowing of fuses, and the occasional destruction of lamps. This may be due to the fact that the lines run through heavy trees nearly all over town. These trees doubtless serve as lightning protection.

Under the present management we have endeavored in general to live up to the rules, and sloppy, careless work we do not advocate at all, but we believe that in small towns, under conditions like these here (and they are to be found in most small towns), much less rigid rules would be quite satisfactory. Some possible changes might allow:

The use of much longer spans than 4.5 feet between supports in wires running on the under side of a surface, provided that they are given a good separation.

The omission of the requirement of an iron box inclosing flush switches, in cases where the contacts on the switch will not touch anything. (This is usually the case.)

The omission of the use of rubber tape. (Friction alone.)

Permission to use lamp cord (of good quality, new Code) for exposed wiring, for loads within its capacity, provided that it be kept free and clear of everything, and be supported on knobs securely. It is hard to see why a lamp cord is any more dangerous running across a ceiling, from which it tends to hang away, and supported securely on knobs, than it would be hanging vertically in the air.

Permission to use heavily insulated flexible cord (such, for instance, as reinforced portable cord), with no restriction whatever, over hooks, etc., for interior wiring, for, say, three or four lamps.

We do not urge that these changes be made universal; it is unquestionable that for large jobs in the city the rules are scarcely strict enough, but in towns like this (and there are thousands of them), the bulk of the load consists of little cottages with from three to ten lamps. First cost is a very important factor in these cases. The fire hazard from other sources, stoves, etc., is far in excess of that from the worst wiring, and it seems as unnecessary to put the same grade of work in tiny places like these, some with but two lamps, as one puts in a large city building, as it would be to insist on fire doors, an automatic sprinkler system, and fire escapes on them. It must be remembered that an installation consisting of, say, five or six small Mazdas all on one circuit protected by a ten-ampere fuse, and served by a two-kilowatt transformer, is a very different fire hazard from a large theater or office building, with normal currents of hundreds of amperes, and a generating capacity back of a short of hundreds of kilowatts.

I should be willing to stake quite a little that in such a small installation as we have here it would be next to impossible to start a fire intentionally from the electric wiring without blowing the fuse, without the use of special appliances.

I trust your committee may be able to do something in this direction.

It is only fair to say that the bad construction existing here has at times resulted in lamp outages, as fused rosettes are used.

Among the Contractors.

R. W. Keck & Company, electrical contractors of Allentown, Pa., have been awarded the contract for the motors and the electrical installation in the Gallia Silk Mills at South Bethlehem, Pa. The immediate requirements call for 70 horsepower with provision being made for an additional 130 horsepower to be installed as future conditions allow. Power will be furnished by the Lehigh Valley Light and Power Company through the Bethlehem substation.

A. P. Mehren, of Downers Grove, Ill., has completed the wiring in the new High School building at that place. He also has the contract for installing semi-indirect fixtures in the auditorium of the building.

A. L. Fink and Company, of Cincinnati, O., have secured the contract for the installation of the wiring and other electrical work to be placed in the new Eichhold garage on Madison Road.

Edward A. Evans will establish an electrical business in Concepcion del Uruguay, Argentine Republic, early in January. He is interested in literature from the manufacturers of electrical appliances.

The Thompson Electric Company has been organized, to conduct an electrical contracting and merchandising business at 102 West Lafayette Street, Tampa, Fla. The company will also conduct a motor repair shop, and invites correspondence with manufacturers and latest complete catalogs, terms, prices and discounts. The officers of the company are S. B. Thompson, president and treasurer; J. McD. Thompson, vice-president and secretary, and W. C. Graham, superintendent of construction.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

Putting Ground Clamps on Conduit.

When putting in a service or doing any kind of conduit work, it is necessary to clean the conduit well before putting ground clamps on. This is generally done with a knife or file and it takes some time and does not clean the conduit any too well. I find that by taking a pair of gas pliers and putting them on the conduit where it is to be cleaned and turning them around the conduit two or three times it makes a bright and clean surface and takes but a few seconds. At the water-pipe end of the ground connection the gas pliers will take off any scale or rust instantly.

E. W. Dullea.

Fishing With Two Snakes.

Where runs are long on a large job, it is sometimes difficult to fish them with one snake. Consequently two snakes are used, and it is necessary to hook one with the other. If the

Shapes for Snake Ends.

two snakes are bent as shown in the accompanying sketch, it will be very easy to hook one with the other when it is twisted around.

George E. Taylor.

Fitting Conduit to Box.

Some time ago I had an occasion to tap an outlet box having one inch knockouts with one-half-inch conduit. By using two iron washers having a diameter larger than the hole in the box; reaming them to a size allowing them to slip over the one-half-inch pipe; and using one on the locknut side and one on the bushing side of the box, I overcame the difficulty.

J. W. Antle.

Cutting Baseboards.

The usual method for cutting openings in baseboards, when wiring old houses to insert a box, is to remove the lugs and then place the box against the baseboard. The outline of the box is marked off and this line used as a guide to saw out the opening. Now when the lugs are replaced it is often found that the opening has not been cut large enough to allow the box to enter. To avoid this difficulty, a good plan is to cut out of heavy sheet tin a rectangular piece of the same size as the box with the lugs in place. Using this as a guide to cut the opening, the box will be found to fit nicely.

R. A. Joseph.

Installing Cabinets.

I recently had to install twelve heavy cabinets, and it was a difficult matter, with only one assistant, to hold the

Frame for Supporting Cabinets.

cabinet plumb and mark the holes for drilling. I consequently made up the wooden frame shown in the accompanying illustration. The height of this frame was equal to the distance specified from the floor for the bottoms of the cabinets. The result was that the job was speedily finished, and all cabinets were plumb and at the right height.

William T. Estlick.

Extension Table Clamp.

When table clamps are attached from floor pushes it is not practical to leave too much wire to hang loose; but in case of an extension table with several leaves in it, a good idea is to take an ordinary shadeholder about one foot long and fasten it to the middle of the table close under the leaves and measure your wire to the end of the table with all the leaves in. Then wrap the wire around shadeholder and when not using full length of table the wire rolls up out of the way.

Ernest Kinerim.

Adding Central Socket to Fixture.

An additional socket may be provided in a ceiling fixture with no central outlet as follows. Take a piece of brass tubing one-eighth inch in diameter and about two inches long, and drill a hole in the side for the wires to pass through. Saw off the rod, which holds the bottom cap of the fixture, about an inch from the cast-iron holder to which the arms are fastened. Then solder the one-eighth-inch brass tube to this rod and to the other end of the tube screw an eighth-inch socket. After connecting up the socket, the cap is replaced at the bottom of the fixture to cover up the wires.

E. G. Quarnstrom.

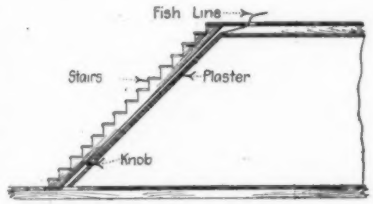
To Facilitate Fishing.

In wiring old houses, a lot of time is frequently wasted in attempting to fish through holes in cross-pieces which have been encountered when trying to drop down for a wall switch, or to reach the basement. A long drill is usually used to bore a hole in such cross-pieces, and afterward there is often difficulty in fishing a chain through this hole. I use a piece of tubing one-fourth or three-eighths inch in diameter, and find the hole with this. The chain can be very readily fished through this tube.

Otto Hanke.

Fishing Under Stairway.

In wiring an old house with brick partitions, a good way to get a line from the second floor to the cellar is by fishing under the stairway. By taking up a pocket at the top of the flight of stairs and tying a knob on a piece of cord, it can be easily determined if the way is clear. This method will save channelling walls. I recently had occasion to use it in running from the cellar to an attic, and found it very satisfactory.



Fishing Under Stairway.

J. B. Story.

Chain-Pull Switch Rosettes.

I have been using pull-chain receptacles to advantage where formerly I thought I had to use a system of three-way switches, or three-way and four-way switches. For instance, in private garages where there are at least two or three doors, I now tie a good quality of fish-line to the chain and carry it through screw-eyes placed on the ceiling or wall, to each of the doors.

In bedrooms I am now using chain-pull switch rosettes, because usually the lamp is desired to hang near the glass instead of high up near the ceiling. The cords from the switch-rosette go one to the side of the door, and the other hangs down at the middle of the head of the bed. There are many other places where the chain-pull and cord can be used to great advantage.

C. W. Goddard.

Public Service Commissions

Conducted by William J. Norton

IDAHO.

John W. Graham, of Twin Falls, Idaho, has been appointed to fill the vacancy on the Public Utilities Commission caused by the resignation of D. W. Standrod.

INDIANA.

The Merchants Heat & Light Company has filed with the Commission a new schedule of rates assessed on a room basis. The rate is 7.5 cents for the first three kilowatts per active room and 5 cents for all excess use, subject to one-half cent discount for prompt payment and a minimum charge of 50 cents per month. The supplement also provided a rate for off-peak service of 2 cents per kilowatt-hour, with a $25 monthly minimum.

NEW YORK—Second District.

Issues of Securities. A number of important security issues have been approved during the last week by the Public Service Commission, Second District. This may be interpreted as an evidence of returning confidence in the securities market on the part of public service corporations.

The Northern New York Utilities, Incorporated, has been authorized to issue $310,000 of securities consisting of $200,000 of its 5-per-cent, 50-year, first-mortgage bonds to be sold at not less than 90; $80,000 of its cumulative 7-per-cent preferred stock, and $50,000 of its common stock. The proceeds are to be used for the acquisition of the stock, franchises, plant and equipment of the Carthage Electric Light & Power Company, together with its obligations. The Carthage company will dissolve.

Rochester Railway & Light Company was authorized to issue $250,000 of its 5-per-cent, 50-year consolidated trust mortgage bonds to refund a like amount of the underlying bonds of the Brush Electric Light Company, maturing January 15, 1915. The new bonds are to be sold or exchanged at a not less than 95 basis. Should the holders of the underlying bonds prove unwilling to exchange for the new bonds at not less than 95, permission is given the company to enter into agreement with such holders, whereby an extension of the time for the payment of the principal may be obtained for one year at an increase from 5 per cent to 6 per cent in interest during that time on the old bonds.

The Olean Electric Light & Power Company was authorized to issue $10,200 par value of its six-per-cent, 30-year first and refunding mortgage bonds at not less than 80, to aid in meeting certain bills and accounts payable, not properly chargeable to operating expense or income.

OHIO.

The Sidney Electric Company was authorized to purchase the property and assets of the Sidney Electric Light Company for the sum of $85,000.

WISCONSIN.

The Burkhardt Milling & Electric Power Company applied for authority to put into effect the following rates for 24-hour service at Baldwin, Wis.:

Commercial lighting—12.5 cents per kilowatt-hour, with a minimum monthly charge of $1.25 per month, subject to prompt-payment discount of 20 per cent on monthly bills up to 40 kilowatt-hours, 25 per cent on monthly bills of 40 to 60 kilowatt-hours, 30 per cent on monthly bills of 60 to 100 kilowatt-hours, 35 per cent on monthly bills of 100 to 150 kilowatt-hours, 40 per cent on monthly bills of 150 kilowatt-hours or over.

Commercial Power—5 cents per kilowatt-hour with a minimum monthly charge of $1.35 per horsepower for the first horsepower and $1.00 per horsepower for each additional horsepower, subject to a discount of 20 per cent for motors using 50 kilowatt-hours per month per horsepower, 30 per cent for motors using 75 kilowatt-hours per month per horsepower, 40 per cent for motors using 100 kilowatt-hours per month per horsepower, 50 per cent for motors using 150 kilowatt-hours per month per horsepower.

No data are available in regard to the cost of service, as a change has been made recently in the ownership and operation of the plant. The Commission authorized the company to put into effect the rates as applied for, with the exception that the minimum charge for lighting service is to be $1.00 with a discount of 20 per cent for prompt payment.

The company also submitted a rule for discontinuing service where bills are unpaid. The Commission says of this: "The proposed rule that patrons not paying for service within a specified time shall have their service disconnected is illegal. The application of a similar rule was before the Commission in the Wylie case—13 W. R. C. R. 518—and in that case it was held that a utility has no right to refuse to furnish service because of the patron's indebtedness to it. The utility can use only the same means of securing payment of delinquent bills as would be available in any other line of business. The utility may, however, require a reasonable deposit to be made to guarantee payment of bills."

Physical Connections of Telephone Companies. Application was made to the Commission for an order requiring physical connection between the Arena & Ridgeway Telephone Company and the Mazomanie Telephone Company. The territories served by the two companies overlap, and the Arena & Ridgeway Telephone Company offers service at $10.00 per year, while the Mazomanie Telephone Company has a rate for similar services of $13.00 per year gross and $12.00 net in the same field. Under these conditions physical connection may result in loss of customers to the Mazomanie Telephone Company, and the Commission points out that the statute authorizing physical connection provides that public convenience and necessity must require connection and that such physical connection must not result in irreparable injury to the owners or users of the facilities of either company. The Commission finds that, under the present conditions, physical connection on any basis which would make its use by the Arena & Ridgeway Telephone Company subscribers practical, would result in irreparable injury to the Mazomanie Telephone Company and that physical connection cannot be required until competitive conditions are discontinued or until rates are equalized. The Commission suggests that the best solution of the difficulty will be for the Arena & Ridgeway company to take over such parts of the Mazomanie system as are in competitive territory and that if this cannot be done, the Commission will consider an application by the Arena & Ridgeway company for authority to increase rates. Until such time no connection will be required.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 240.—Life of Gas-Filled Tungsten Lamps.—What is the longest life record as yet attained on test or in service with the new nitrogen-filled tungsten lamps?—P. C. U., Springfield, O.

No. 249.—Automatic Open-Circuit Tester.—In some fire-alarm systems of the open-circuit type I am told that some device is provided for automatically testing the lines from time to time to see that they are in working condition. How is this done? Has it been used to check the condition of telephone lines?—D. K. Y., Ogden, Utah.

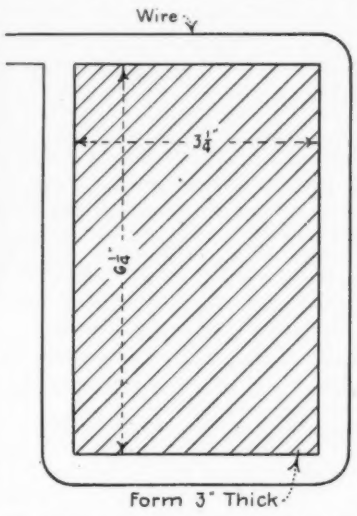
No. 251.—Life of Flashing Sign Lamps.—In the case of a flashing sign equipped with tungsten lamps is the life of these lamps shortened due to the continual flashing?—H. D. V., Lafayette, Ind.

No. 255.—Automatic Cutout for Series-Multiple Lamps.—Is there any way of arranging one or more switches and fuses on a 440-volt circuit so that when there are four 110-volt lamps connected in series one may burn out without affecting the other lamps? Are there any devices on the market and approved by the Underwriters for preventing all the lamps on such a circuit from going out when one burns out, or is there any way of overcoming this difficulty? If there is any way, please show the arrangement by a diagram.—V. J. L. N., New York, N. Y.

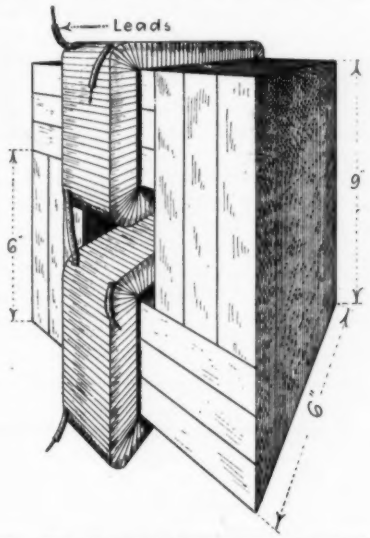
Answers.

No. 252.—Building an Autotransformer.—I am anxious to build an autotransformer compensator for 440 volts primary and 110 volts secondary. It should carry 40 amperes on the secondary. I have on hand a lot of the best sheet iron three-fourths inch by five inches and one inch by six inches, also double cotton-covered magnet wire Nos. 11 and 9 B. & S. gauge, also varnished cambric 0.009 and 0.013 inch thick. I should like some information on the number of turns of wire to use, how to wind it, the thickness of the core, and other points to look out for in building the outfit.—J. A., Benson Mines, N. Y.

The iron you have is hardly of the right size to make a well proportioned transformer, but you can assemble the one-inch by six-inch iron side by side to make it three inches wide by six and build a transformer which will work satisfactorily. The cross-sectional area of the core will be 18 square inches and its dimensions three inches wide by six inches thick. The total number of turns will be 320, 80 turns being wound with double No. 9 and the remainder, or 240 turns, of single No. 11. The coils should be wound first. Make a form about 3.25 inches by 6.25 by 3. If you have no sleeving, tape up the end of the wires where you start to wind the coil, so that it cannot "short" with any of the turns and wind 40 turns of double No. 9 in four layers of 10 turns each per layer, which will take up a space of 2.5 inches wide and about one-half inch deep. Insulate between each layer with one thickness of 0.013-inch varnished cambric. Now tap on with No. 11 and bring out a tap for one of the 110-volt leads. Wind on 120 turns of No. 11, insulating each layer as above. Take coil off form and heat to a temperature of about 200 degrees Fahrenheit in an oven and dip same in a bath of some good insulating varnish and bake until dry. Insulate the inside of coil with three or four thicknesses of varnished cambric or paper and tape same. Make another coil as above. After coils are wound and taped arrange both so that when they are in proper position as per diagram the current will flow through the opening in the center of core the same way in both coils with two inside leads of the double No. 9 taped together. Now assemble core around the coils breaking joints, that is, the joint on one side one time and on the other the next, etc. It will be well to insulate the coils from one another in the opening between the two with a strip of mica as they will fit together tightly. The current from the 440-volt circuit flows from the outside of one coil through the small wire to the large and then through the large winding of the other coil to the small and out, as per sketch. After the transformer core is assembled it can be clamped together on either end with clamps and bolted tight. The core is rather short but as you have the iron it will probably work all right.—E. M. R., Saginaw, Mich.

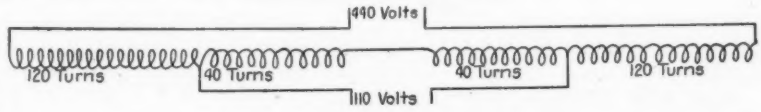


No. 252.—Form for Winding Autotransformer Coils.



No. 252.—General Arrangement of Autotransformer Core and Coils.

No. 253.—Cable Pot Heads.—Is it customary to require pot heads or equivalent devices on lead-covered cables for voltages below 500?—C. R. H., Pittsburgh, Pa.



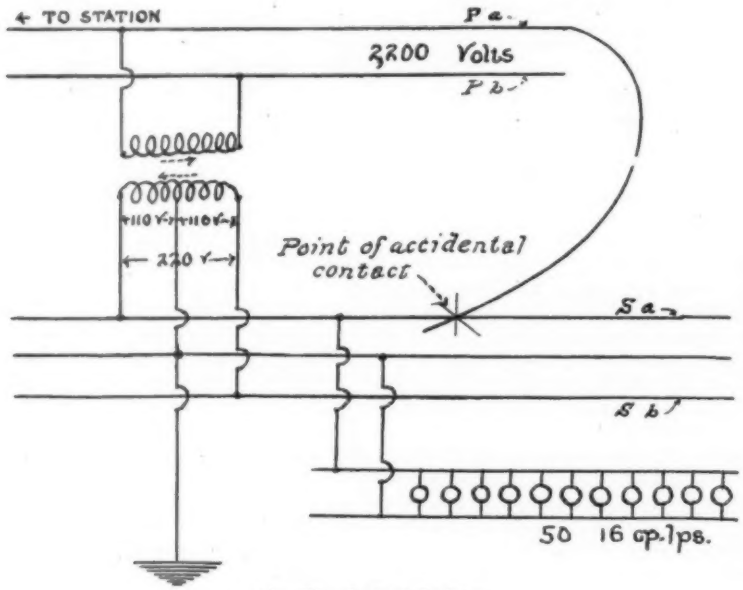
No. 252.—Wiring Diagram of Autotransformer.

It is customary to require a pot head on such cables.—J. H. M., San Francisco, Cal.

No. 254.—Ground Problem.—A certain transformer supplying a dwelling and residential district, the load consisting chiefly of lamps for indoor illumination, is supplied from a 2,200-volt circuit carried on top of the cross-arm of each pole; the secondary wires are strung on separate cross-arms, placed four feet below and run parallel to the primaries. The secondary system is three-wire, 220-110 volts, with neutral permanently grounded at some point near the transformer. At the moment of an accident of the nature shown by the accompanying diagram, the

case where the primary wire marked *Pa* would become detached, or broken, and fall across the secondary marked *Sa*, would the high-tension current rush to ground through that half of the secondary coil, by overcoming its reactance, or would it tend to follow the path of low resistance, approxmiately 4 ohms (resistance of the load at time of contact) to ground through the neutral?—J. H. M., Quebec, Canada.

It is assumed that some point on the primary circuit, other than the side *Pa*, is also grounded; otherwise nothing would happen, since it is the same as connecting the two left-hand ends of the primary and secondary together without connecting any other points of their respective circuits. With this assumption, the imposition of something like 2,200 volts on the low-voltage secondary circuit would cause very heavy current rushes through both the load circuit and the left half of the secondary winding in inverse proportion to their respective



No. 254.—Ground Problem.

impedances plus counter electromotive forces.

If the lamp load consists of 16 carbon lamps, each having a resistance of about one-half ohm, their joint resistance would be but one-fiftieth of this, or one-hundredth ohm (not 4 ohms, as stated). Consequently there would be an instantaneous current of several hundred thousand amperes, in other words, the lamps would act almost like a dead short-circuit and therefore be burnt out in a jiffy.

On the transformer coil the short-circuit would not be quite so violent, because the impedance of the coil plus its counter electromotive force of 110 volts would have to be overcome; therefore the current would be less, but in all likelihood sufficient to seriously damage, if not burn out the coil.—T. H. G., Elgin, Ill.

Boise City Council Supports Position of Electric Companies.

In special session held Thursday, November 19, the City Council passed resolutions addressed to the Public Utilities Commission asking that no undue burden of expense be put upon the electric companies operating in Boise in connection with the building, maintenance or extension of the transmission or distributing systems.

These resolutions come as a result of the informal conference on the matter held by members of the council on Wednesday afternoon, when it was shown to them that the telephone company had made application to the Public Utilities Commission to compel the electric companies, wherever their lines carrying 5,000 or more voltage, crossed above or under the wires of the telephone company, to either place their wires in an underground conduit or to insulate them so as to thoroughly protect the wires of the telephone company.

The resolutions further ask that the Public Utilities Commission show no more favor to the telephone company than that accorded the electric companies, and the mayor of the city is authorized to attend the forthcoming hearing of the Commission and to present a copy of the resolution at that hearing.

All of the members of the council were present at the meeting and the resolutions were passed by a unanimous vote. The full text of the resolutions is as follows:

"Be it resolved by the mayor and common council of Boise City:

"That we respectfully suggest to the Public Utilities Commission of the State of Idaho that it is the sense of Boise City that no rules or regulations should be adopted by the commission in connection with the line of construction hearing, set for hearing the first day of December, 1914, which will impose any unnecessary burden or expense upon the building, maintenance or extension of electric transmission or distributing systems.

"It is further the sense of this city that no rules or regulations should be adopted which tend to favor the telephone companies at the expense of the electric companies, or which will recognize anything but equal rights between the two classes of utilities.

"We authorize the mayor of this city to attend said hearing and present this resolution on behalf of Boise City."

New England Power Company's Development.

Construction of the new development of the New England Power Company on the Deerfield River in Western Massachusetts, is well under way. Conduits, canals and tunnels are being constructed, to bring the waters of the river from Monroe Bridge, Mass., 3 miles, to the station, known as No. 5, near Hoosac Tunnel. Advantage is taken of the circuitous course of the river, and its swift fall, to give an available head of 235 feet at the power house—the highest head utilized in New England. The intake and control gates are at Monroe Bridge, just below the dam of a paper company, and the water is conducted, first through a tunnel blasted in the solid rock, 12 feet in diameter. Thence a concrete, reinforced conduit, also 12 feet in inside diameter, and constructed with 24 longitudinal iron bars and circular hoops 6 inches apart, electrically welded on the ground, conducts the water across a ravine and brook and delivers it to an open canal 6,500 feet long, whence it flows through a tunnel 1,150 feet in length, a second conduit and a 3,000-foot canal, in succession. A surge tank is to be located at the power house, and the generators will be operated by wheels supplied through two penstocks, 7 feet in diameter.

The No. 5 development is another step in the full utilization of the stream flow of the Deerfield, on which the New England Power Company already operates four hydroelectric stations, and in connection with a plant on the Connecticut River at Vernon, Vt., distributes electrical energy throughout Massachusetts, southern Vermont and New Hampshire, with Rhode Island as the objective, once the new plant is in operation.

The contract with the Power Construction Company, which is in charge of the work, calls for its completion in the early spring.

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 14.

Given the magnetization curve (See Fig. 14, page 1141) of a series generator at 1,200 revolutions per minute. The continuous current-carrying capacity of the armature is 137 amperes; resistance of series field, 0.05 ohm; demagnetizing mmf. of armature at 137 amperes load, 600 ampere-turns; resistance of armature between brushes, 0.08 ohm; number of turns on series field, 30. Note that magnetization curve is obtained by *separately exciting* the machine.

Find (*a*) terminal voltage when armature current is 137 amperes; (*b*) the resistance which must be connected in parallel with the series winding to give a terminal voltage of 100 volts when the line current is 137 amperes, and (*c*) the percentage decrease of the machine capacity when the speed is reduced to 1,000 revolutions per minute, the series field being unshunted as in Question *a*.

SOLUTION OF PROBLEM 14.

Answer to Question a.

The mmf. of the series field equals 30×137, or 4,110 ampere-turns. Subtracting the demagnetizing mmf. of the armature, the net mmf. then equals 4,110 —600 or 3,510 ampere-turns. The corresponding armature voltage (Fig. 15, Solution of Problem 13, or see Fig. 14 in statement of Problem 15) is 191 volts. The terminal voltage is then given by [3] $V_t = 191 - 137\ (0.08 + 0.05) = 173.2$ volts.

Answer to Question b.

The series field being shunted with an unknown resistance, the current (I_s) in the series field is unknown. A trial computation may be made assuming that the series field current (I_s) is about one-half of the total current or 70 amperes. The armature voltage (E_a) is then given by [3]

$E_a = 100 + 137\times0.08 + 70\times0.05 = 114.5$ volts.

The net mmf. required to produce this armature voltage is given in Fig. 14, and is found to be 2,150 ampere-turns. The gross mmf. must then be 2,150+600, or 2,750 ampere-turns. Hence the series field current must be 2,750/30, or 91.7 amperes.

Since this value of the series field current exceeds that assumed above, a new value of series field current must be assumed, say 92 amperes. Then by [3] $E_a = 100 + 137\times0.08 + 92\times0.05 =$ 115.6 volts.

The net mmf. required to produce an armature voltage of 115.6 volts is found from Fig. 14 to be 2,160 ampere-turns and the gross mmf. must be 2,160+600 or 2,760 ampere-turns. The series field current then equals 2,760/30, or 92 amperes. The current in the series field shunt is 137—92, or 45 amperes. The resistance voltage in the series field [4] equals 92×0.05 or 4.6 volts, which must also equal the resistance voltage in the series field shunt. Hence the resistance of the series field shunt [6] equals 4.6/45 or 0.102 ohm.

The "internal characteristic" of a series generator is a curve obtained by plotting armature voltage (ordinates) and line current (abscissas). This characteristic will have the same general shape as the magnetization curve shown in Fig. 14, but each ordinate will be shortened by the effect of armature reaction.

The "external characteristic" of a series generator is a curve obtained by plotting terminal voltage (ordinates) and line current (abscissas). This characteristic will have the same general shape as the "internal characteristic," but each ordinate will be shortened by the resistance voltage of the armature and series field. By applying the principles set down in the answers to **Questions a** and **b**, one may construct these two characteristics from the magnetization curve.

Since the terminal voltage fluctuates widely with the load, this type of generator is not adapted to the conditions of constant-potential service with varying loads. If the generator be so designed, however, that the field yoke be highly saturated at full load the effect of armature reaction will be to reduce the armature voltage if the armature current increases slightly. This condition alone causes the machine to give an approximately constant current with varying voltage over a limited range. If in connection with this inherent property of the machine some mechanical device is added which varies the resistance of the series field shunt or changes the position of the brushes, the series generator may be made to give a constant current over a wider range.

This type of generator is used extensively on series arc-lighting circuits. Each lamp contains a relay switch which short-circuits the lamp when not burning and since the voltage impressed upon such a circuit equals the product of the voltage per lamp into the number of lamps, the extinction of any one lamp calls for a reduction in the total voltage impressed upon the circuit. The series generator as described above accomplishes this automatically since the extinction of a lamp decreases the total resistance of the circuit. The slight increase in current which results decreases the armature voltage to the proper value required by the remaining lamps. It should not be assumed from this discussion that the series generator is a constant-current generator inherently, since the condition of saturated field yoke and mechanical aid must be provided. It should furthermore be noted that under the same conditions a shunt generator would serve as well, but since the voltage of such constant-current generators is usually several thousand volts the difficulty and expense of constructing a shunt field winding to withstand such voltages prohibits the application of the principle to shunt machines.

Answer to Question c.

When the armature current of the machine is a maximum the mmf. of the series field equals 137×30, or 4,110 ampere-turns.

The net mmf. is then 4,110—600, or 3,510 ampere-turns. By constructing a short section of the (1,000 R. P. M.) curve above the mmf. of 3,510 ampere-turns, as indicated in Problem 13 and shown in Fig. 15, it is found that the armature voltage at 1,000 revolutions per minute and net mmf. of 3,510 ampere-turns is 160 volts. The terminal voltage by [3] is then

$V_t = 160 - 137(0.08 + 0.05) = 142.2$ volts.

A maximum output is given by [19]

$P = 142.2\times137 = 19{,}500$ watts.

A maximum output at 1,200 revolutions per minute, using the results obtained in answer to **Question a** is given by [19]

$P = 173.2\times137 = 23{,}700$ watts.

Percentage reduction in capacity is $(23{,}700 - 19{,}500)\,100/23{,}700 = 17.7$ per cent.

SOLUTION OF PROBLEM 64.

Answer to Question a.

Consider a transformer which has a ratio of transformation from high-tension to low-tension voltage of *a*. If a

ALTERNATING CURRENTS.

Problem 64.

A 50-kilovolt-ampere, 22,000-440-volt, 60-cycle transformer has the following constants:

High-tension winding: Resistance, 64.4 ohms; leakage reactance, 229 ohms. Low-tension winding: Resistance, 0.0257 ohm; leakage reactance, 0.092 ohm.

(*a*) What are the equivalent resistance and the equivalent reactance on the high-tension side? (*b*) What are the equivalent resistance and the equivalent reactance on the low-tension side? (*c*) If the low-tension winding is short-circuited, what voltage should be impressed on the high-tension winding in order that there will be full-load current in both windings? What power will be supplied? (*d*) If the high-tension winding is short-circuited, what voltage should be impressed on the low-tension winding in order that there will be full-load current in both windings? What power will be supplied? (*e*) If a reactor which has a resistance of 0.05 ohm and a reactance of 0.10 ohm is connected in series with the low-tension winding, what will be the equivalent resistance and reactance of the high-tension side of the transformer and added reactor?

certain voltage, V, usually in the neighborhood of five per cent of the rated voltage, is impressed on the high-tension winding and the low-tension winding is short-circuited there will be full-load current in both of the windings. V is called the full-load equivalent impedance volts of the transformer on the high-tension side. If the high-tension winding is short circuited and a voltage $V \div a$ is impressed on the low-tension winding there will be full-load current in both windings. $V \div a$ is the full-load equivalent impedance volts on the low-tension side.

If, in the first case, I is the full-load high-tension current the ratio of V to I is called the equivalent impedance, Z, of the transformer on the high-tension side. If the power supplied to the transformer is P, the ratio of P to I^2 is called the equivalent resistance, R, of the transformer on the high-tension side. The equivalent reactance on the high-tension side is $X = \sqrt{Z^2 - R^2}$.

If the full-load high-tension current is I amperes and the ratio of transformation is a, the full-load low-tension current is aI amperes. The equivalent impedance on the low-tension side is equal to the voltage impressed on the low-tension side divided by the current in that side when the high-tension winding is short circuited.

Low-tension $Z = (V \div a)/aI$

$= V/I\,a^2$

V/I is the high-tension equivalent impedance. Thus the equivalent impedance on the high-tension side is equal to the equivalent impedance on the low-tension side multiplied by the square of the ratio of transformation. Like relations exist between the equivalent resistances and reactances on the two sides.

The equivalent resistance and reactance of a transformer can also be calculated if we know the ratio of transformation and the resistances and reactances of both the high-tension and low-tension windings. Let r_1 and r_2 be the resistances of the high-tension and low-tension windings and x_1 and x_2 the reactances.

Let a be the ratio of high-tension to low-tension voltage. The equivalent resistance, R_1, on the high-tension side is:

$$R_1 = r_1 + a^2 r_2$$

Likewise:

$$X_1 = x_1 + a^2 x_2$$

The ratio of transformation is 22,000 to 440, or 50.

$$R_1 = 64.4 + 50^2 \times 0.0257$$
$$= 64.4 + 64.2$$
$$= 128.6 \text{ ohms.}$$
$$X_1 = 229 + 50^2 \times 0.092$$
$$= 229 + 230$$
$$= 459 \text{ ohms.}$$

Answer to Question b.

Let R_2 and X_2 represent the equivalent resistance and reactance on the low-tension side.

$$R_2 = r_2 + \frac{1}{a^2} r_1$$

and

$$X_2 = x_2 + \frac{1}{a^2} x_1$$

$$R_2 = 0.0257 + 64.4/2{,}500$$
$$= 0.0515 \text{ ohm.}$$
$$X_2 = 0.092 + 229/2{,}500$$
$$= 0.184 \text{ ohm.}$$

Answer to Question c.

The equivalent impedance on the high-tension side is given by [5a]

$$Z = \sqrt{128.6^2 + 459^2}$$
$$= 477 \text{ ohms.}$$

The full-load current on the high-tension side is

$$I = 50{,}000/22{,}000$$
$$= 2.27 \text{ amperes.}$$

The necessary impressed voltage is by [3a]

$$V = 2.27 \times 477$$
$$= 1{,}080 \text{ volts.}$$

The power supplied is, by [4a]

$$P = 2.27^2 \times 128.6$$
$$= 664 \text{ watts.}$$

There is a very small core loss also, but this is usually neglected on short-circuit.

Answer to Question d.

The equivalent impedance on the low-tension side is given by [5a]

$$Z = \sqrt{0.0515^2 + 0.184^2}$$
$$= 0.191 \text{ ohm.}$$

The full-load current on the low-tension side is

$$I = 50{,}000/440$$
$$= 113.6 \text{ amperes.}$$

The necessary impressed voltage is, by [3a]

$$V = 113.6 \times 0.191$$
$$= 21.7 \text{ volts.}$$

The power supplied is, by [4a]

$$P = 113.6^2 \times 0.515$$
$$= 664 \text{ watts.}$$

Answer to Question e.

Let r_0 and x_0 represent the resistance and reactance of the reactor which is added to the low-tension side, and let R and X represent the equivalent resistance and reactance on the high-tension side of the transformer and reactor.

$$R = r_1 + a^2 r_2 + a^2 r_0$$

and

$$X = x_1 + a^2 x_2 + a^2 x_0$$
$$R = 128.6 + 2{,}500 \times 0.05$$
$$= 253.6 \text{ ohms.}$$
$$X = 459 + 2{,}500 \times 0.10$$
$$= 709 \text{ ohms.}$$

Electric Plowing.

Some experiments made in Italy with electric plows resulted in the following estimates of comparative costs: with animals, $5.30 to $5.75 per acre; steam, $4.30; electric power, $3. The ground was plowed to a depth of 15 inches, and the above costs were obtained on the basis of 200 days' work a year and energy at 3 cents per kilowatt-hour. In the same district for 100 days' work a year, with electricity at 4 cents per kilowatt-hour, the costs were: steam, $5.07, and electricity, $3.36 per acre. Other plants in the same district are said to have reduced electric plowing to $2.83 per acre.

Estimates made on 741 acres electrically plowed showed capital invested, including 8 kilometers of line, $8,280; operating expenses, including depreciation on plant, $4,324.

Plowing with steam was figured at $4,360; using gas engines, $4,368; and using oil engines, $4,285.

Fuel in this district costs, for coal, $12 per metric ton; wood per quintal, $8; petrol, per 5 gallons, $1.80; kerosene, per quintal, $7.

DIRECT CURRENTS.

Problem 15.

Given the magnetization curve (Fig. 14) of a compound generator at 1,200 revolutions per minute. The generator is rated at 230 volts and 30 kilowatts. The shunt field has 1,000 turns, the series field, 30 turns; resistance of armature, 0.08 ohm; resistance of shunt field, 50 ohms; resistance of the series field, 0.05 ohm; demagnetizing mmf. of armature at full load, 600 ampere-turns. The shunt field is connected between the line wires. Find (*a*) resistance of series-field shunt to give 230 volts at terminals at full load; (*b*) terminal voltage of machine at no load under the conditions obtained in Question *a*, and (*c*) terminal voltage of machine at line current of 80 amperes with series-field shunted as in Question *a*.

This problem illustrates the effect of load upon the terminal voltage of a compound generator.

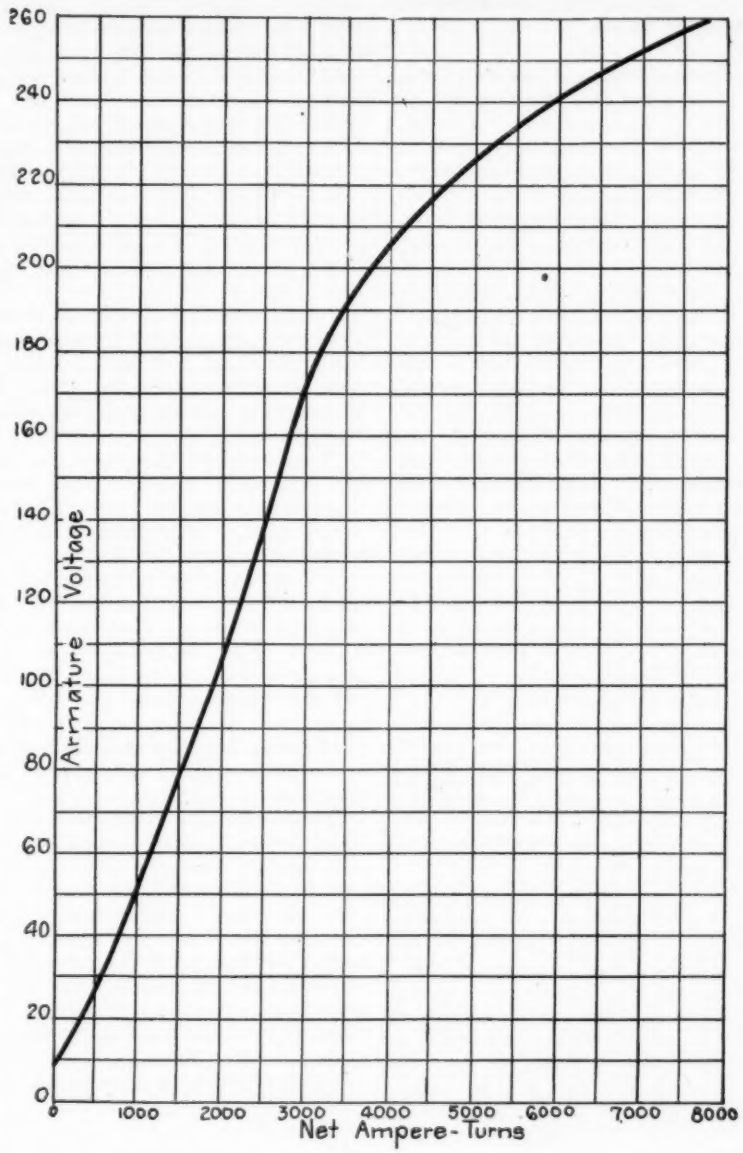


Fig. 14.

ALTERNATING CURRENTS.

Problem 65.

The open-circuit and short-circuit data for a 500-kilovolt-ampere, 60-cycle, 11,000:2,200-volt transformer are: Open-circuit, watts = 2,950, volt-amperes = 7720; short-circuit, volts = 347, amperes = 45.5, watts = 3380.

The low-tension winding is short-circuited and measurements are made on the high-tension side. (*a*) Calculate the regulation of this transformer when it delivers 500 kilowatts at unit power-factor and the rated voltage. (*b*) Calculate the regulation of this transformer when it delivers 400 kilowatts at 0.80 power-factor and the rated voltage. (*c*) Calculate the efficiency for a load of 125 kilowatts at unit power-factor. (*d*) Calculate the efficiency for a load of 500 kilowatts at unit power-factor. (*e*) Calculate the efficiency for a load of 400 kilowatts at 0.80 power-factor. (*f*) Calculate the all-day efficiency for the following condition: a load of 500 kilowatts at 0.95 power-factor for four hours, a load of 350 kilowatts at 0.88 power-factor for six hours and no load during the remaining fourteen hours of the day. The transformer is connected to the supply mains twenty-four hours each day.

This problem illustrates the calculation of the regulation and efficiency of a transformer.

Solutions of the above problems and two new problems will be printed in the next issue.

Siamese Municipal Electric Plant.

At Bangkok, Siam, there was recently completed a municipal electric power plant with three 1,000-kilowatt Curtis stam turbo-generators. Paddy husk, a by-product of rice milling, is the chief fuel, although facilities have also been provided for using fuel oil, coal or firewood. A large 110-cell storage battery is part of the electrical equipment installed.

This station provides lighting for a large area occupied by royal palaces and residences for Siamese nobles. The motive power for operating the machinery of the Bangkok waterworks and the opium factory is also supplied by this plant.

GOVERNMENT OWNERSHIP AND MUNICIPAL OWNERSHIP CONDEMNED.

Discussion at Annual Meeting of the National Civic Federation.

The fifteenth annual meeting of the National Civic Federation was held at the Hotel Astor, New York, on Friday and Saturday, December 4 and 5. Hon. Seth Low, president, called the meeting to order at 10:30 a. m. Friday. In his comprehensive annual address, Mr. Low called attention to the many industrial and social problems the future has for us, growing out of the European war, and favored a greatly increased merchant marine. He criticized the Interstate Commerce Commission for its attitude in the past respecting an increase of railroad freight rates. He said at this point:

In my report a year ago I called the attention of the federation to the fact that in Germany, where the railroads are publicly owned, the rates charged for freight are approximately double those prevailing in the Eastern district of this country, while the rates charged passengers—taking all classes together—are about one-half those prevailing in the same district here. The same policy is found wherever the railroads are owned by the State. Since then the Interstate Commerce Commission has declined to grant the petition of the Eastern railroads for an advance in freight rates of 5 per cent, except in a very modified form, while, on the contrary, the Commission has advised these railroads to advance their passenger rates.

"It is true that the Interstate Commerce Commission is now reconsidering, upon the petition of the railroads, its decision denying for the most part the application of the railroads for an increase of 5 per cent in freight rates, but, even if this reconsideration results favorably to the roads, the policy of the Interstate Commerce Commission in declining an advance in freight rates and in advising the advance of passenger rates, stands out in marked contrast to the policy of all countries where the railroads are publicly owned.

Governmental versus private enterprise was the topic that received full attenion Friday afternoon, Vice-president Samuel Gompers in the chair. An audience that filled the large meeting room was in attendance, many ladies being present.

Prof. Jeremiah W. Jenks of New York University first reviewed present-day tendencies toward the substitution of governmental control of private enterprise. He said: "We need identical systems of cost accounting so that we may judge between the private enterprise and the same enterprise under government control. On the basis of present meager knowledge I am opposed to the state doing some of these things."

Congressman David J. Lewis then declared for government ownership of telegraph and telephone lines. Congressman Lewis touched on government ownership of railroads and then F. G. R. Gordon, of Massachusetts, took a passing shot at that as he spoke in opposition to government ownership. It costs, he said, as much to move a bushel of wheat a mile on the "socialized railroads of Australia as to send a bushel from Chicago to Liverpool"; and he added: "The statistics show that practically every government-owned railroad, telegraph and telephone gives rotten service and pays poor wages."

Congressman Lewis had used the Post Office Department as an example of the efficiency of government operation of a public utility, and it was to this that Mr. Gordon principally effectively replied.

"They bring up the post office system," he said. "Why, it's the worst managed big business in the country."

He asserted that the Postmaster-General and his chief subordinates are paid, not from the proceeds of the business they manage but by the Treasury Department, and that the salary list thus "made a present of" amounts to about $3,000,000 a year. He said that $59,000,000 had been expended for buildings occupied by the department, but not paid for out of its earnings or charged against it; and he added:

"Down to 1913 $150,000,000 had been spent by the Treasury Department for the benefit of the Post Office Department. From 1865 to 1913 the department received in revenues $3,775,000,000 and expended $4,555,000,000 in expenses, a loss of about $279,000,000. Add four per cent interest on public buildings and salaries of officers and the loss from 1865 has been $14,000,000 a year. And you call it a socialistic success. How'd you like to raise potatoes on that scale?"

He explained how the railroads had to carry the parcel post free for six months or more because contracts are figured on a basis of weight and the weighing is done once in four years; and he went on, while the members of the federation laughed and applauded.

"If a shoe manufacturer could get his rent free and have to pay only 75 per cent of his transportation charges, would it be any wonder if he made a howling success, while his competitors went bankrupt?"

Mr. Gordon picked flaws in Congressman Lewis' statistics of telegraph and telephone cost here and in countries where the lines are operated by the government. He said that in Great Britain the system had paid no dividends since the government took it over, and had lost $200,000,000 in 43 years. Government-owned telegraph systems in Germany, France and Australia are run at a loss, he said, and the same is true in New Zealand for both telephone and telegraph. And he insisted that, making a fair comparison, rates are little if any higher here, while the service is better beyond compare.

In conclusion he said:

"Everywhere government ownership has been characterized by inefficiency and cursed with red-tapeism; has provided low wages and has shown a large deficit. The half-baked socialists who preach it are merely helping the red-flag revolt that many people believe is sweeping this country."

Frederic C. Howe, commissioner of immigration, advocated municipal ownership of public utilities, largely on moral grounds, as obviating graft and taking franchise prizes away from individuals.

Ex-Senator Jonathan Bourne, Jr., who was not able to be present, sent a paper in which he took the side against government ownership. He said that government operation of railroads would mean similar ownership of telegraph and telephone lines and express companies; that this would require more than 3,000,000 government employees, who, with their relatives, could control any national election.

In the course of his argument he said:

"Centralization of power in the national executive is the greatest menace to popular and representative government, and if the present tendency continues must inevitably lead to complete bureaucracy and dictatorship."

A view directly opposite that expressed by Dr. Howe as to the advantages of municipal ownership was set forth by J. W. Sullivan, who was chairman of a Federation of Labor committee that inquired into conditions among laboring men abroad. Wages on the city-owned tramways in England, he said, had not advanced at a quarter of the rate they have for street-car men here, and he complained that "municipalism breaks down trade-union principles; it substitutes for them a one-sided dictation which strips labor of independent action in its own behalf."

On Saturday the question of social insurance was discussed in the forenoon, with George W. Perkins in the chair. Among the speakers were Arthur Williams, M. W. Alexander, J. W. Sullivan and Mr. Perkins.

Electrical Society Learns Astronomy.

At the meeting of the New York Electrical Society on December 4, a lecture was delivered by Worcester R. Warren on "An Evening With the Planets and Stars." The lecture was of exceptional interest.

The Trained Man and His Opportunity Discussed by Minnesota Engineers and Jovians.

The great and increasing demand for highly trained men in the electrical industry and the excellent opportunities open to men in this profession who are willing to equip themselves for intelligent and efficient service were points emphasized by Prof. George D. Shepardson, head of the department of electrical engineering of the University of Minnesota, at a meeting of the Minnesota Section of the American Institute of Electrical Engineers at the University of Minnesota, Minneapolis, Nov. 23. Professor Shepardson has been connected with the university for more than a quarter of a century. In all that time he has observed the demand for highly trained men to exceed the supply, and he does not believe there is reasonable likelihood that the future will see a lack of opportunities in this field. Rather the industry is growing so fast that the problem is how to keep up with it, Professor Shepardson said.

The meeting was a joint affair in which the St. Paul and Minneapolis Jovians participated. L. H. Cooper, chairman of the Minnesota Section, presided. Mr. Cooper explained that the purpose of the meeting was to acquaint the Jovians with the methods and equipment at the university so that they may know more of the opportunities offered through extension courses.

Professor Shepardson told of the growth of schools among commercial electrical concerns and trade unions throughout the country, the purpose underlying all being to increase the efficiency of the employee. Business men know, he said, that they will get results from their plants in proportion to the number of trained men they keep around them, because trained men will be able to think better, quicker, and farther than untrained men.

The National Electric Light Association committee on the relation between the colleges and industries, of which Professor Shepardson is chairman, was cited in illustrating the way emphasis is being placed on education. At the recent meeting in New York, from which Professor Shepardson just returned, plans were discussed for sending men from the industries to the colleges to tell the colleges what the industries are doing, and inviting the colleges to send lecturers to tell the men in the industries what the colleges are doing. A committee on employment, the speaker said, has for its purpose to get electrical engineering students and members of the faculties to spend part of their vacation time working at the large central stations.

"The National Electric Light Association," said Professor Shepardson, "believes an effort should be made to furnish jobs for electrical engineering students at the central stations in summer, for in this way the boys will eventually be brought into the industry. Commercial concerns are looking for more and better men. They feel that they must offer inducements to students to enter the work because in proportion as students see that the big men in the industry are looking for them, and that opportunities for advancement await them, will they choose to enter the field."

As an indication that there is small likelihood of lack of opportunities in the electrical industry in the future, Mr. Shepardson said that the loads on central stations are increasing at the rate of about 20 per cent a year, that the output of incandescent lamps has increased about 600 per cent in the last 14 years and that the same conditions prevail in the manufacture of telephones and other electrical equipment.

Prof. Richard R. Price, director of extension work at the University of Minnesota, told how the extension departments of the great state universities have opened up opportunities for all the people regardless of their means or social standing. He likened extension departments to a great lighthouse which sheds its beneficient rays over a large area and in the base of which there is a power plant connected by wires with the homes of all the people. So that those whose way is not lighted by the arc lamp in the tower have but to press a button in their own homes to get their share of the illumination.

Arthur L. Abbott, St. Paul, told of promising efforts being made to secure a new building for the electrical department of the university. Resolutions were offered by C. M. Congress, of the St. Paul Jovian League; W. T. White, of the Minneapolis Jovian League, and Mr. Abbott on behalf of the Minnesota Section urging the speedy realization of the building project, and were unanimously adopted.

The session closed by the members going to the electrical laboratories where they were shown the equipment and numerous experiments and "stunts."

Electrical Engineers and Their Work in War Time.

Electrical men in the United Kingdom who are denied the privilege of serving with the forces at the front or on home defense are subjecting themselves to heart searchings as to how they can best serve their country in their ordinary avocations. Thomas Roles, city electrical engineer of Bradford, had something to say on this subject in the course of his address as chairman of the Yorkshire Section of the Institution of Electrical Engineers. Taking as his theme the war and its effects upon the electrical industry, he said there were other demands besides going to the front, namely, keeping electric supply industry going, keeping manufacturing operations in full swing supplying the needs of the army and the navy. If after full inquiry the electrical engineer's position could be left vacant or reasonably well filled, it was apparent that the place of that man was in the fighting line. Among the many ways in which one at home could assist, Mr. Roles said there was the duty to carefully consider the methods of educating and training young electrical engineers with a view to reorganizing and improving methods of manufacture in order that in future the designing, as well as the manufacturing of electrical apparatus required for the naval and military services should be carried out by British-born subjects. Special attention should also be given to business training, so that the methods of British firms might be entirely up to date and their sales organization controlled by Britishers. The speaker later referred to the economies which everybody was being urged to practice during war time, and he said that electric lighting and heating were looked upon by many as luxuries, and if money was to be spent only on the bare necessaries of life "our own profession is likely to be one of the first to suffer."

While trade was slack obsolete plant should be replaced and improved methods of driving adopted. If manufacturers with capital would adopt that course the electrical industry would be benefited at a critical time, and the manufacturers would reap their reward later. If some scheme could be devised and put into operation by means of which manufacturers having limited capital could obtain new plant on reasonable terms the country in general would benefit both immediately and in the future. Electricity supply undertakings in particular should take the opportunity of carrying out schemes of reorganization which would provide work during any period of depression which might be experienced, and render them ready to meet the large demand which would undoubtedly be made on them at a later date. The difficulty of keeping ahead of the demand during recent years had given engineers in charge of such undertakings little breathing time to consider many details which would amply repay attention and a period of slackness might profitably be utilized by such persons in critically examining their

plant and installing various devices tending to economy in working, as well as in carrying out schemes of extension.

The economically minded might be further encouraged to proceed in this direction if they realized the likelihood of plant and material rising in price immediately a boom in trade is experienced.

Mr. Roles said he was of the opinion that by gradually increasing, within reasonable limits, stocks of meters, motors, and other apparatus, for hiring, during any period in which the electrical industry was at a low ebb, electricity supply engineers would not only exhibit patriotism, but economy and business prescience, as his faith led him to believe that within a comparatively short time after the conclusion of the war matters electrical would go forward with great rapidity. If manufacturers would from time to time notify purchasers for which lines of goods orders were required to keep their hands employed steps might be taken to assist them by placing orders for stock purposes. Advertising and canvassing for orders for electric supply business and salesmen's efforts must on no account be relaxed during war time.

Activities of Minneapolis Jovians.

Minneapolis Jovians to the number of 59 attended a dinner at the Rogers Hotel December 1. Tribune W. T. White presided and Wallace G. Nye, mayor of Minneapolis, delivered an address on municipal industries, making frequent allusions to opinions advanced at the meeting of mayors in Philadelphia.

Mr. White reports the initiation of active work in several important enterprises undertaken by the League. Arrangements are already under way for a reception and dance in honor of the Western Electrical Inspectors on the occasion of their convention in Minneapolis late in January. A campaign is under way to interest Minneapolis electrical concerns in taking out sustaining memberships in the Jovian League. This is expected to meet with favorable results from the start, as electrical business men are aware of the value of Jovian enthusiasm in developing their industries. The concerns will be asked to contribute whatever they see fit to the support of the League.

Another important work for which a committee has been appointed is the getting out of a book which will contain the constitution and by-laws of the local organization and a complete roster of all the members, giving Jovian potentials, home addresses, telephone numbers, and the names of the firms with whom the members are associated.

Immortalizing Jovians.

A plan has just been adopted by the Columbus (O.) Jovian League by which each member will have his personality established for all time in the archives of the organization. Each person now a member is to supply a photograph of himself, together with brief biographical data, the same to be separately mounted and filed in loose-leaf form. The record will be kept up to date by adding further information to the individual leaf, such as a change of business connection, any marked achievement in the electrical field, or other matter deemed worthy of mention. The same plan will be pursued with respect to new members as they come into the league. This will be a valuable and interesting record, and one of increasing historical worth.

At the annual meeting of the Columbus Jovian League, held December 4, a splendid address was made by E. A. Reed, general manager of the Central Union Telephone Company for Ohio, on the subject "Co-operation." Its principles were made to apply to every branch of the electrical field, and to all of the inter-relations among employees, even those existing between the chief officials and the day laborer. Co-operation, in its fullest sense, was shown to be the true road to efficiency and economy. A short, pertinent address was made by A. E. Loeb, of Columbus, Triton of the Thirteenth Jovian Congress.

President Metz appointed committees as follows: Finance, William Hopkins, A. E. Loeb, E. A. Reed, Harold Clapp, L. A. Sackett; Constitution and Resolutions, F. C. Caldwell, D. K. Morris, E. G. Eastman; Nominations, J. W. Davis, T. G. Lawrence, J. T. Dunnick, J. C. McMasters; Roster, A. E. Flowers, L. A. Sackett, D. H. Morris, and Harry Lynn.

No further Jovian meetings of any kind will be held until after the holidays. On the first week in January the league will elect officers for the coming year, the event to be in the nature of a luncheon at the Virginia Hotel. A rejuvenation will take place in February.

Ohio State University, through its electrical department, is to entertain the League the third week in January. Prof. C. A. Caldwell, head of the electrical engineering department at that institution, is chairman of the League, and other members of the university faculty take an active part in it. The entertainment will consist of a banquet at Ohio Union, the general club house on the campus, a visit to the electrical laboratories and a demonstration of wireless telegraphy and telephony.

Minnesota - Wisconsin Companies Merge and Extend Operations.

The Red Wing Gas, Light and Power Company of Red Wing, Minn., the Winona Gas Light and Coke Company of Winona, Minn., the Minnesota-Wisconsin Power Corporation, which serves Lake City and Wabasha, Minn., with electric light and power, subsidiaries of the American Public Utilities Company, have been merged with the Wisconsin-Minnesota Light and Power Company, a corporation recently organized as a subsidiary of the American Public Utilities Company, to take over the properties of the Chippewa Valley Railway, Light and Power Company. These properties will all be operated under the supervision of A. E. Peirce, vice-president of the Wisconsin-Minnesota Light and Power Company has acquired the ters at Eau Claire, Wis.

A transmission line is now being built from Altoona, Wis., which is already served by the Wisconsin-Minnesota company, to Fairchild, Wis. This line will be continued to Neillsville where the Wisconsin-Minnesota Light and Power Company have acquired the property of the Neillsville Electric Company.

From Ellsworth, where the company is already serving the community with electric light and power, a line is being built to carry a 66,000-volt transmission to Prescott, Wis., and to Hastings, Minn.

Thomson Lectures on Wireless.

Elihu Thomson gave an instructive lecture on "Wireless Telegraphy" before the Lynn section of the American Institute of Electrical Engineers on the evening of December 2, the attendance being the largest of the season.

The first part of the address was devoted to showing that the laws governing wireless transmission of electric currents are not essentially different from those relating to ordinary transmission, and it is not so much in the discovery of new effects of electric waves as in the practical application of well known laws that the marvelous success of recent years has been attained. A full discussion of the sending apparatus in wireless telegraphy was entered into, and freely illustrated with lantern slides. The research work of Hertz, Lodge, Fessenden and others was given due notice, and the happy outcome of the Marconi experiments and apparatus explained.

Prof. Thomson illustrated briefly the receiving apparatus of wireless telegraphy, and then touched on wireless telephony, in regard to which latter there seemed no reason to doubt that a successful system of oversea transmission would yet be accomplished.

THE PHILADELPHIA CONFERENCE.

By H. G. D. Nutting.

The position taken by some of the speakers at the recent conference on public utilities at Philadelphia, particularly by Mayor Harrison of Chicago, indicates either a lack of knowledge or a prejudiced view of public-utility regulation.

After considerable experience as an engineer for a public service commission, and as an operator and manager of public utility properties both municipal and private, I am convinced that state regulation by commissions is the best answer that has been offered to the problem so far.

That, in the words of Mayor Harrison, there has been considerable "rough stuff" handed out in the past by some public utilities, particularly in the larger cities, is probably true. That there has always been a politician in waiting to receive the spoils also seems evident. This has been the case under the very conditions that the city representatives are supporting, that is, "home rule" or "municipal ownership." In the latter case the dishonest politician has a clear field for action, for he not only has the opportunity for graft but controls the source of it. With the utilities corporately owned and state regulated there is considerable question as to his ability to get to the source of it.

I am not entirely opposed to municipal ownership. There are some well operated municipal plants, but they are few and far between. I admit that "home rule" and "public ownership" are both correct in theory. They fail in practice.

The state, not the city, is the unit and source of government. If home rule in the matter of public-utility control is extended to cities, why not extend it to wards and precincts? And then why not carry it a step farther and let each man run the government in his own way? Municipal control has been tried and found wanting. State control has proven to be successful so far.

Rates and quality of service of public utilities are so closely related and of such a degree of technique that the average city is not in a position to regulate them. The problem is becoming more complicated by the construction of long electrical transmission lines and the interconnection of communities with interurban railways.

"Home rule" is only another excuse for local politicians to keep their fingers in the pie, and to have something to build political platforms upon. It is always easy to scare up opposition to a public-utility corporation, not because it has particularly offended, but because it exists. Its very presence is a signal for a fight—just like an Allies' ship in German waters.

There are many cases where the public has a right to complain of service These are cases very often not under the control of the "company," but acts of its agents. Every manager knows the difficulty in educating his employees to do those things which mean good service and satisfaction to the public. Public plants are no less offenders in this matter than are corporations, inasmuch as this condition is a matter of human nature which is the same whether the plant be owned by a person, corporation, or municipality.

"Public ownership" would end the struggle between the public and the corporation, but low rates and good service would not necessarily follow. No headway is made by exchanging the dividend-hungry stockholder for the graft-hungry politician. If graft and dishonesty can not be kept out of a police force, how can it be kept out of a public utility owned by the public, where large sums of money change hands?

The smaller cities of the country can not decently maintain a city hall. How long can they be expected to operate their complicated electric light plant successfully?

It is true that some cities own and operate their waterworks with good results. If the waterworks of Chicago were owned by a corporation, how long would the public stand for such second-story conditions as exist in Chicago in the matter of lack of pressure? And, for technical reasons, the operation and management of a waterworks is a much simpler proposition than the operation of an electric light and power or electric railway plant.

That public utilities go to some length for profits can not be disputed. What incentive is there to invest money in any extensive construction enterprise unless there be promise of profit? That every possible fair method be used to get business is both good and necessary. By development of large business the cost per unit is less. The lower the cost per unit of public-utility service, the lower the possible rate to the consumer. The lower the rate to the consumer the more universal the use of the service, and so on to the saturation point. What is good for the public is good for the public utility, and *vice versa*.

That rates for gas and electricity have grown less while service has become better in the last twenty years is a fact, not a theory. That a longer ride can be obtained for a nickel is also a fact.

It is true that the personal factor is an important consideration in the appointment of regulatory bodies. This is no less so in local commissions than in state commissions. It is doubtful if any question has been raised as to the honesty of any member of the 28 state commissions now in force.

Perhaps the oldest commission practicing modern regulating methods is the Railroad Commission of Wisconsin. I have never heard any expression of suspicion of dishonesty or graft on the part of this commission. When the public has lost cases it has been critical and dissatisfied; when the corporation has lost its case it has been critical and dissatisfied; when municipally owned utilities have lost cases they have been very critical.

Experience in the operation of a municipal plant taught me that the "public" sees the municipally owned plant in exactly the same light as it sees the corporation. The details of its operations are obscure and what is obscure to the public, it believes to be questionable. In either case the object is to beat the "ultimate consumer."

That public ownership would increase the responsibilities of local government can not be gainsaid. How the public will accept these responsibilities is evidenced by the many publicly owned plants now in existence. "What's everybody's business is nobody's business" is no theory, "Let George do it'" is the slogan in public ownership. If George sees the opportunity he does it and in his own way.

Mayor Harrison concedes that privvate ownership is more economical than public ownership, but that publicly owned plants can pay better wages. Every business man knows that, if the American working man must have better wages, the ultimate consumer must pay them, particularly in the public-utility business.

The sooner that the public realizes that well regulated public utilities are the greatest source of benefit existing in their cities, the better it will be for all concerned.

But good regulation can not come from within.

And public ownership is not the answer.

Hydroelectric Plant in Africa.

The British electric central-station company in Angola, Portuguese West Africa, is completing a hydroelectric plant on the Catumbella River. A 23-mile 20,000-volt transmission line will connect the new plant with the three largest towns. Mangrove wood has been used as fuel in the present steam plant. For current for private parties the company charges 50 cents per kilowatt-hour for light and 11 cents for power.

Street-Lighting Requirements.

William E. Wickenden, electrical engineer and expert in street lighting, has issued a report on the quality and adequacy of the public lighting of the City of Waltham, Mass., with recommendations for its improvement.

Waltham is a community of about 30,000 people, 10 miles west of Boston. It is a suburban residential and high-class industrial city, the home of the Waltham watch. The lighting company serving this territory is the Edison Electric Illuminating Company of Boston.

Professor Wickenden says in his report, that while the company is faithfully fulfilling its contract, much should be done to bring the service up to date. The lighting of the two principal business streets is said to be far below an adequate standard, due to the old-style type of arc lamps employed, their too wide spacing and too low position. The lighting of most of the residential streets, with 40-candlepower incandescent units, is fairly good.

The report sets forth some data which is of value in its application to street lighting in general. It is pointed out that a city of the type of Waltham requires the use of about five types of lamps—an arc or high-powered incandescent of not less than 1,000 candlepower; an incandescent of say 600 candlepower, and smaller units of 100, 80, and 60 candlepower.

Professor Wickenden recommends the Boston magnetite arc lamp, using 6.6 amperes and about 510 watts and equipped with a light opal globe and enamelled metal reflector. "This type of lamp," says the report, "is of proven serviceability, is of high efficiency and produces light of an excellent white color. To produce a uniform and effective distribution of light, these lamps should be about 25 feet above the street grade. The use of a diffusing globe is very important."

The second type of lamp recommended is the nitrogen-filled lamp of about 600 candlepower, inclosed in a light opal globe and surmounted by a metal housing and reflector similar to that recommended for the arc lamps. The smaller units of the type now in use are proper for their uses, with mounting 15 feet above grade, in view of the presence of shade trees.

The report divides the streets into four classes. For streets of the "A" class, which comprise the principal business thoroughfares, high-power arc lamps are recommended, suspended 20 to 25 feet above street grade and spaced 250 to 300 feet apart. The present wiring for street lighting in Waltham is all overhead; hence installing a decorative system of illumination should be deferred for the time being.

For class "B" streets, those of secondary importance, a mixed system of high-power and low-power units is advocated. Here arcs and high-power incandescents should be hung as high as foliage and construction requirements allow. The maximum distances from each of the types of lamp to point in the street receiving minimum illumination which is consistent with best results are as follows:

	Maximum distance
6.6-ampere magnetite arc	250 feet
600 -candlepower incandescent	200 feet
100 -candlepower incandescent	125 feet
60 -candlepower incandescent	100 feet

Class "C" streets, comprising thoroughfares to adjoining towns, can be served by incandescent lamps, at important intersections 600-candlepower being suggested, with 100-candlepower and 60-candlepower intervening. The maximum distances from point of minimum illumination should be 250 feet for the 600-candlepower, 150 feet for 100-candlepower, and 125 feet for the 60-candlepower units.

Class "D" streets, being those of lesser significance, can best be served by 80 and 60-candlepower lamps, though 40-candlepower will prove satisfactory. The maximum distances from points of minimum illumination are 200 feet for the 80-candlepower, 175 feet for the 60-candlepower and 150 feet in the case of the 40-candlepower lamps. Little-traveled country roads, however, may have 40-candlepower units spaced from 400 to 500 feet apart.

The city engineer is urged to have a map showing the location and type of all lamps in service.

On the subject of rates, Professor Wickenden says the cost of lighting fixtures, installation, and of special station appliances used in connection therewith calls for an allowance of 15 per cent to cover interest and depreciation. To this is added the cost of renewal of lamps, globes, etc., repairs, inspection and cleaning, and the cost of the energy to operate the lamp for 4,000 hours a year, at a reasonable wholesale rate. Slight added allowance is made for administration. It is the belief of Professor Wickenden that the rates for service can be made with reasonable profit to the lighting company as follows:

6.6-ampere magnetite arc	$78.50 per year
600-candlepower incandescent (high-efficiency)	59.00 per year
100-candlepower incandescent	25.00 per year
80-candlepower incandescent	22.00 per year
60-candlepower incandescent	19.50 per year
40-candlepower incandescent	18.00 per year

The radius of distribution in Waltham being less than in most of Boston, and the service being all overworked, Professor Wickenden holds that Waltham is justified in asking for rates suggested above.

A Watt-Hour Meter Method of Testing Instrument Transformers.

In a forthcoming paper to be published by the Bureau of Standards, P. G. Agnew tells how ratio and phase-angle measurements of instrument transformers may easily be made by the use of two precisely similar watt-hour meters, which may be of either the portable type, or of the house type provided the disk has been graduated in 100 divisions. The meters should be adjusted to very nearly the same rate.

The method depends upon the use of a standard transformer whose ratio and phase angle have been determined in some laboratory equipped for the purpose. The standard transformer must have the same nominal range as the one under test.

For voltage transformers an auxiliary current is passed in series through the current coils of the two meters. The voltage coil of each meter is connected to the secondary of one of the transformers, whose primaries are in parallel on the supply. Readings are taken showing the difference in speeds of the meters. The meters are then interchanged and readings again taken. If the meters have been operating at, or very near, unity power-factor, the ratio of the transformer under test is easily computed in terms of the ratio of the standard. The formula is

$$\frac{R_2 - R_1}{R_1} = \tfrac{1}{2}\left(\frac{a_1 - a_2}{a_2} + \frac{b_1 - b_2}{b_2}\right)$$

where R_1, R_2=ratios of the transformers; a_1, a_2=numbers of turns of meter A when connected to transformers 1 and 2, respectively; b_1, b_2=same for meter B.

Similarly the difference in phase angles may be determined by running the meters at low power-factor, which may be conveniently done by taking the auxiliary current from one of the other phases of a three-phase source. If the meters are working at the power-factor $\cos\theta$, current lagging,

$$\tan\alpha_2 = \tan\alpha_1 + \frac{1}{\tan\theta}\left[\frac{a_1 - a_2}{2a_1} + \frac{b_1 - b_2}{2b_1} - \frac{R_2 - R_1}{R_1}\right]$$

where α_1 and α_2 are the phase angles of the transformers, counted as positive for the reversed secondary voltage leading the primary voltage.

For current transformers the method of connecting the coils is inverted, compared with the case of the voltage transformer. An auxiliary voltage is applied to the voltage coils of the meters in parallel, the current coils being connected to the secondaries of the two transformers. Care should be taken not to open the secondary circuit of a current transformer while current is passing in the primary.

The formula for the difference in ratios is the same as for the voltage transformer. The formula for phase angle is correct as given both for the voltage transformer with lagging current and for the current transformer with leading current. If the conditions are *vice versa*, the + sign before the bracketed term should be changed to —.

It is, however, not necessary to depend upon this equation for determining which transformer has the greater phase angle. The following facts may be used as criteria for experimentally determining the question.

(1) Adding a non-inductive load to a voltage transformer always tends to lag the secondary voltage.

(2) Increasing the resistance in the secondary of a current transformer tends to advance the phase of the secondary current.

The experimental results show that by taking runs of approximately 100 turns each the method is capable of determining ratio to 0.02 or 0.03 per cent, and phase angle to one or two minutes. In commercial work shorter runs would suffice.

There are cases in which it may be convenient to determine a lump correction for both ratio and phase angle instead of determining and correcting for them separately, for example, the case of a watt-hour meter and a current transformer metering the power supplied to an inductive load. This may even be extended to the case of the combination of a current and a voltage transformer.

Portable watt-hour meters are more convenient than the house type with graduated disks as the trouble of counting is eliminated. In testing current transformers a five-ampere range is more economical of time than a ten-ampere range. One-ampere or two-ampere ranges should not be used with current transformers as the impedance introduced into the secondary is too great.

It is important that the constants of the standard transformer should have been tested under actual working conditions of load, including the meter.

The accuracy of the method is ample for commercial requirements, the results are independent of ordinary line fluctuations, and no special apparatus is required.

Substation Standardization.

Dr. H. F. Parshall contributed a most exhaustive paper on economics of electric railway distribution before the Institution of Civil Engineers, London, on November 17. Its chief object was to assist towards the standardization of electric-railway substation practice. The author said that many years ago Lord Kelvin formulated a law as to the economic use of conductors in transmission systems. The number of independent variables when a complete system with substations had to be dealt with was so great that the mathematical expression from which might be deduced the minimum cost, would in practice be open to some suspicion. Dr. Parshall in his paper gave a complete balance sheet embodying every item worked out for each case, and the tabulated result was included as a part of the paper; hence for different conditions it would be possible for an engineer to make the necessary corrections, so that without any great amount of labor the methods and results in the paper might be applied to practically any class of electric railway installation. The author did not extend his work to include the electric traction installation as a whole, since the process of standardization in respect of motor equipments was still proceeding, and conclusions that might be drawn under present conditions would in another short time be incorrect. The distribution conclusions were likely to be lasting, since the operating conditions on which the general results were founded were likely to obtain for a considerable time to come.

With the given energy-consumption per unit of length of line that follows from a given train-movement, the capacity of the substations increases directly with the distance between them. The energy-loss in distribution conductors of a given section varies with the cube of the distance between substations. The cost of attendance is within wide limits independent of the size of the substation. The cost of the plant per kilowatt falls off with the size of the units, but the maintenance and renewals per kilowatt are more or less constant. Dr. Parshall gave a series of curves showing graphically the arrangements of substations that would operate different train services on different electrical systems, and at various voltages with a minimum total operating cost. With rotary converter substations and a working voltage of 600 volts and for certain assumed average conditions of train-weight, speed, and energy-consumption the most economical substation spacings were 8.5, 5.5 and 3.25 miles for train services of 6, 12, and 24 trains per hour, respectively. For a working voltage of 1,200 volts the substation spacing was 11, 7.5 and 5 miles, respectively, while when 2,400 volts was adopted the most economical substation spacings were 16, 12, and 8.5 miles for the three train services, respectively. By means of curves the author illustrated the advantage gained by working at higher voltages; the curves confirmed his view that with the present arrangement of rotary converter substations, there was very little advantage in a higher voltage than 2,400 volts for the track conductor. The economy of higher voltages was shown to be approximately the same whatever the train service. As between 600 and 1,200 there was a saving of 14 per cent in the total annual costs of the distribution system; as between 1,200 and 2,400 volts there was a further saving of 7 per cent, or 21 per cent as between 600 and 2,400 volts. If the working voltage was further increased to 3,600 volts there was a decrease in total annual expenditure on substation and overhead conductor equipment of only 3 per cent, which would be less than the additional cost of the rolling stock.

Dr. Parshall said that for single-phase distribution at 5,000 volts the most economical substation spacings were 31, 24 and 16 miles for train services of 2, 3 and 6 times, respectively. At 10,000 volts, single-phase, the most economical substation spacings were 45, 34, and 26 miles for the same three train services, respectively. With three-phase distribution at 5,000 volts, the most economical distances between substations were 38, 31 and 18 miles for the same respective train services. In most of these last cases, however, the economical distance between substations thus determined was greater than would be permissible in practice from considerations of both traffic-operation and voltage drop. Further, in the case of single-phase operation the lower pressure of 5,000 volts was found to be the most economical for certain services, and the higher pressures of 10,000, 12,000 and 15,000 volts, in vogue on the Continent, were explained by considerations of voltage-drop.

Dr. Parshall based his calculations largely on the substation operating costs of the Central London tube railway.

Tampering with Electric Wires Under Penalty in Kansas City.

An ordinance has been passed providing a penalty for damaging or tampering with electric wires used for the transmission of electric current, unless permission for such tampering has been obtained from the owners. The ordinance also makes it unlawful for any person to light or extinguish, without authority, any lamps maintained for public safety or convenience, or to fasten any animal to any lamp post or pole carrying service wires.

Publicity for Telephone Men.

At the meeting of the Telephone Society of New York to be held at the Engineering Societies' Building, New York City, on the evening of December 15, N. C. Kingsbury will read a paper on "Publicity."

New Electrical and Mechanical Appliances

Yost Insulating Joints.

A new line of fixture-insulating joints has been placed on the market by the Yost Electric Manufacturing Company, Toledo, O. These joints have been carefully designed to more than fulfill the strict requirements of the National Electrical Code. As shown in the skeletonized view, the malleable-iron pipe connections have special enlarged flanged ends, which are completely imbedded in the insulating compound and thus make a joint that is exceptionally strong and which can therefore resist any strain that is liable to be applied. The pipe threads are clean cut and of the standard Briggs iron-pipe thread type.

For the body of the joint there is used the high-grade insulating material known as Thermoplax, which is made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Skeletonized View of Yost Insulating Joint.

This compound is mechanically very strong, very dense and gas-tight, moisture-proof, heat-resisting and is not affected by gas or corrosive vapors. This material is applied under very high pressure, so that the interior of the shell is molded into a solid mass. An outer drawn-steel shell protects the body when the wrench is used. Within the lower part of this outer shell is a reinforcing ring or extension shell to give still additional strength to the outfit. The body is carefully inspected before the outer casing is put on. The complete joint is further impregnated with insulating compound cured at a high temperature and tested to 4,000 volts between the two pipe connections and between each of these and the shell.

These joints are made in all standard sizes and in several types for either straight electric or combination gas and electric fixtures. The threading is for either both ends female or one male and the other female.

Pipe Taplet Tap Block.

A new tap block has been designed for Paiste Pipe Taplets, which will fit all the way down in the Taplet, although there is plenty of space under it for a third wire. This tap block does away with all soldering, either of branch wires to the main wire, or of tap wires for fittings. The main wires are bared for three-eighths of an inch,

Paiste Tap Block.

and fastened to the binding screws of the tap block. The tap or branch wires are fastened to the connecting binding screws.

These tap blocks are approved by the underwriters and make a very safe joint without any risk of short-circuiting. One size fits both one-half and three-quarter-inch Pipe Taplets.

The Hart & Hegeman Manufacturing Company, Hartford, Conn., is sole

Making a Branch in Pipe Taplet With Tap Block.

selling agent for these, as well as other, Paiste fittings.

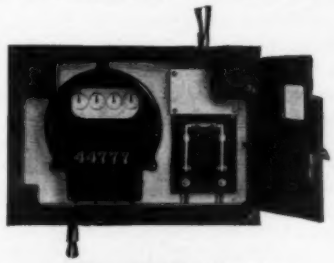
Meter Box to Permit Reading Meter from Outside of House.

One of the important elements in the cost of rendering electric or gas service is that of reading the meters each month. Meters have been installed many times in relatively inaccessible rooms or closets, to reach which requires not only entry to the house, but also climbing of flights of stairs, disturbance of occupants, etc. Even when all the meters are installed in the basements, much time is consumed in waiting at the door and getting access to the basement. Housewives resent interruption in their affairs, tracking in of dirt by metermen in stormy weather, and the impositions occasionally caused by unscrupulous strangers posing as representatives of the service company. A happy solution of all these difficulties is the practice followed in some cities, in the residence districts at least, of placing the meter on or in one of the outer walls of the house and protecting it from the elements and from tamper-

Front View of Meter Box.

ing, but making it possible for the meterman to read the dials without waste of his time or disturbance to the occupants of the house.

Of the methods of meter installation to permit achieving these benefits probably the most noteworthy is that employing a special metallic casing for the meter and service switch. This box is built right into one of the foundation or other readily available walls just



Interior View of Meter Box.

as a window casing would be. The general appearance of the box itself, both closed and open, and of the small and inconspicuous wall opening behind which it is recessed is well shown in the accompanying illustrations. The box is made of a good quality of iron, and is strongly built. Its outside dimensions, for alternating-current meters, are 14.5 inches wide, 7.25 deep and 10.25 high; for direct-current meters the

height is 17.375 inches. The installation can be made in stone, brick, concrete, wood or any other kind of walls. A strong hinged front door with lock gives access to the meter for installation or testing, and to the service switch in emergency. A glass window in the door permits reading the meter without even opening the door. Since the meter box is set in somewhat and is locked, full protection is provided againts storm or tampering.

Usually the service wires are brought in through conduit shown above the upper right corner of the open box. The house wires pass out below the meter. If the service wires are brought down in conduit on the outside of the house right to the meter box, the central-station company can pass them through either of the two knockouts in the upper corners of the box front. This is very convenient when old houses are to be connected for service. The box can be set into an old wall with little trouble. Fastened to the back iron wall of the box is a wood board to facilitate mounting of the meter and service switch.

Similar boxes are made for the installation of gas meters. Both types of these boxes are known as D-B Gas-Elect Meter Boxes, and they are manufactured by the Donley Brothers Company, East Seventy-fourth Street and Aetna Road, Cleveland, O.

Meter Box Installed to Permit Reading Meter from Outside of House.

Motor-Driven Peanut and Pop-Corn Outfit.

A Motor-Driven Peanut-Roaster and Corn-Popper.

Advertising prestige pays in every line of business. Even the peanut and pop-corn vender has found that style is a great profit-maker. He is now no longer satisfied with humble equipment, but demands an outfit that will raise him to the level of the great mercantile establishments around which he plies his trade.

To meet this demand the Kingery Manufacturing Company, of Cincinnati, Ohio, has provided a peanut and pop-corn cart "de luxe," glittering in nickel and plate glass, illumined with electric lamps at night, and operated by a Westinghouse Electric small motor.

Current is obtained from a plug at the vender's stand. The motor drives the peanut-roaster and the rotary corn-popper. Heat is obtained from gas or gasoline.

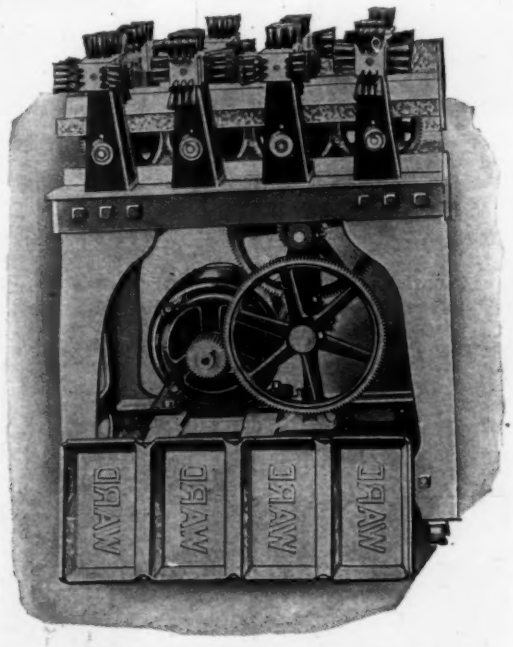
These carts form a small but attractive load for central stations, as connections are easily installed, and there is no meter to read, flat rates being usually charged. The cost of the cart is reasonable, while payments can be made on easy terms.

Electric Bread-Pan Cleaning and Greasing Machine.

The illustration herewith shows a rather unique motor application—a machine patented and manufactured by Gottschalk & Company, Reedsville, Pa., for cleaning and greasing bread pans. By means of a set of stiff brushes the pans are cleansed. The opposite set of soft brushes is then used for greasing the pans. By cleaning the pans thoroughly before greasing them the machine eliminates any spots on the bread. It is also claimed that the pans are greased much more uniformly than where they are greased by hand, with a great saving in lard and the elimination of any loaves sticking to the pan. With the machine one-half pound of lard will grease about 2,000 pans.

These machines are equipped with one-fourth and one-half-horsepower motors, manufactured by the Robbins & Myers Company, Springfield, O. The outfits are furnished with direct or belt-connected motors, as desired. The direct-connected motors are equipped with back gears operating the brushes at the slow speed of 70 to 80 revolutions per minute. This means long life for the brushes, and prevents any throwing of grease. The motor is mounted on the frame of the machine below the brushes, and is protected from crumbs and grease by a metal cover.

The outfit is mounted on casters, so it can be moved about easily and connected to any lamp socket



Motor-Driven Bread-Pan Cleanser and Greaser for Large Bakeries.

Telephone Dispatching on Street-Railway Lines.

Until a few years ago electric street-railway lines had no uniform method of dispatching cars. The method of dispatching was usually one of starting cars at certain intervals and checking the maintenance of schedules by having inspectors stationed at various points along the road to keep things moving. The use of the telegraph was not taken into consideration. This would have entailed the establishing of way stations with experienced operators, inasmuch as the crews of street cars could hardly be expected to be prepared to send and receive messages over telegraph instruments. The need of a satisfactory dispatching system was felt particularly on interurban lines where it often became necessary in an emergency for a car crew to communicate with the dispatcher and the dispatcher to communicate with the car crews and the inspectors.

The increasing use of the telephone for the efficient dispatching of trains on steam and high-speed electric railways has led to its adoption by some of the leading electric street-railway companies as the simplest and most efficient means for controlling the movements of cars.

An equipment that is one of the most complete of its kind has been put in operation by the Milwaukee Electric Railway & Light Company. Three switchboards are in service, one for the use of the train dispatchers, another for handling all calls within the Public Service Building, in which the company's offices are located, and a third for handling public telephone messages operated by the Wisconsin Telephone Company.

Telephone Station Along City Car Line.

Telephone Wire Chief's Headquarters.

Telephone Station Along Suburban Line.

The train dispatchers' switchboard is a Western Electric six-panel, three-position board with two of the positions in service at present. The equipment of the four panels now in use is sufficient to talk to the 240 telephones located at various points along the car lines. These telephones, which are usually found at transfer points and track intersections, are mounted on poles that may be readily distinguished by broad yellow bands painted on them a short distance above the telephones. The telephone instruments are of two kinds, the metal-box type operated on central battery within the city and the familiar Western Electric magneto wood telephone for the outlying districts. The latter are inclosed in shelter booths. There are also 25 loud-ringing call bells located at track intersections, parks, etc. These are mounted on poles with the telephone instruments and are used to signal the supervisors. They are operated from the train dispatcher's switchboard.

On the top of the switchboard in the first position is placed a small lamp-signal box which indicates open bridges or closed steam-railway-crossing gates,

Telephone Dispatching Board for Milwaukee Electric Railway System.

Telephone Switchboard in Public Service Building.

thus enabling the dispatcher to note the location and length of all delays to traffic. Harmonic ringing is used.

The dispatchers handle 490 trains and receive approximately 3,900 calls daily. In all 1,600 miles of telephone circuits are operated, a part of the telephone lines being in lead-covered cable, of which there is a total of approximately 80 miles.

A commercial switchboard for handling calls within the Public Service Building is made up of a single section arranged for three operators and equipped for 270 commercial lines, which connect 425 telephones, some of which are on party lines in the suburban districts. This switchboard, also manufactured by the Western Electric Company, is connected through to the dispatcher's switchboard to take care of transferred calls. Three private branch-exchange switchboards are operated in conjunction with the main switchboard, one at Cold Springs operating 38 lines, one at Racine with 15 lines, and another in the way department with 10 lines. In conjunction with the commercial and dispatcher's switchboards, there is a complete power plant, distributing frame and terminal board and wire-chief's equipment.

The company switchboard operated by the Wisconsin Telephone Company has 65 extension telephones connected to it. There are ten trunk lines, four of which are for incoming calls exclusively. One private line connects directly with the trouble department and has a "silent" number known only to the outside trouble men and heads of departments.

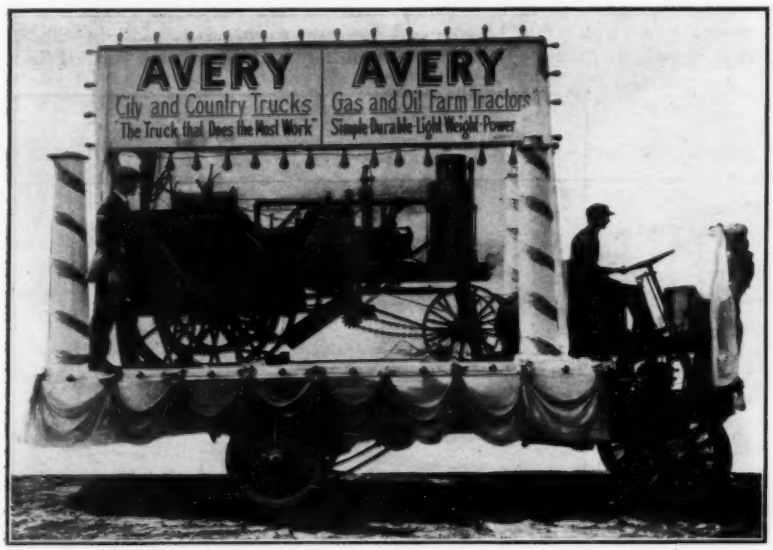
This equipment has now been in successful operation for a number of months and has made it possible to maintain an absolutely satisfactory working schedule.

Float Electrically Lighted by Tractor-Driven Generating Set.

An ingenious method of lighting a large float was used in the electrical parade held during the recent National Implement and Vehicle Show at Peoria, Ill. The parade was under the joint auspices of the Jovians and the Peoria Electric Club. The float shown was entered by the Avery Company, of Peoria, Ill., manufacturer of gasoline and oil engines, tractors, trucks, farm implements, etc. The float made a "hit" and won first prize.

An Avery truck formed the portable platform of the float. Its front was decorated with the bulldog emblem of the company. Mounted on the float was a powerful Avery tractor, whose engine independently drove a 10-kilowatt direct-current, 110-volt generator. For over 2.5 hours the tractor drove the dynamo steadily and supplied a uniform voltage for the nearly 100 Westinghouse Mazda lamps used for lighting and decorating the float. A 150-watt lamp on a 12-inch roughed-inside glass ball was mounted on each of the four corner columns. Green lamps were used for outlining. The lamps used were all taken from ordinary stock, and ranged from 40 to 50 watts in size. Throughout the parade not a single lamp filament was broken. On the return trip on a side street two of the top lamps were broken by contact with a low guy wire across the street. The float was designed by and electrically equipped under the supervision of F. S. Simms, electrical engineer of the Avery Company.

The Avery trucks and tractors are of very rugged construction, being designed particularly for use on the farm and country roads. The tractors are extensively employed for pulling large plows and other agricultural implements, and for driving various farm machines. They are being employed even for the very severe military service in the European war.



Electrically Lighted Float with Generating Equipment.

Front View of Float.

Turbogenerators for New Haven and Bridgeport, Conn.

The United Illuminating Company, New Haven, Conn., has arranged to add to the equipment of the Grand Avenue station in New Haven two 4,000-kilowatt Curtis steam turbogenerators. In the Congress Street station at Bridgeport, Conn., will be installed two additional 2,500-kilowatt Curtis units of the same type. The contract to build these machines and all accessories has been awarded the General Electric Company. It is anticipated that the new units will be placed in operation some time next spring.

These two stations have an interesting history. The United Illuminating Company was originally known as the New Haven Electric Company. When its plant was first started in 1893, it was located on Temple Street. The equipment then consisted of four 2,000-candlepower Thomson - Houston series arc machines, divided in pairs and steam-engine belt-driven. The first year the load was strictly store lighting, but during the second year some street lighting was included. Later in the summer of 1886 saw the first house lighting and a 400-ampere Thomson-Houston generator was added. Gradually the station developed until it consisted of 14 series arc machines and six of the 400-ampere ma-

chines. In 1890 this entire equipment was moved to the new station, the present Grand Avenue station.

The old station, at present known as the George Street station, was then equipped with General Electric generators, of which there are now eight installed, direct-connected to engines in pairs. These are still operating, but will go out of service next spring. They will be replaced by 500-kilowatt three-unit motor-generator sets, which will be driven by alternating current from the Grand Avenue station, generating direct current and sending it out over the present direct-current switchboard.

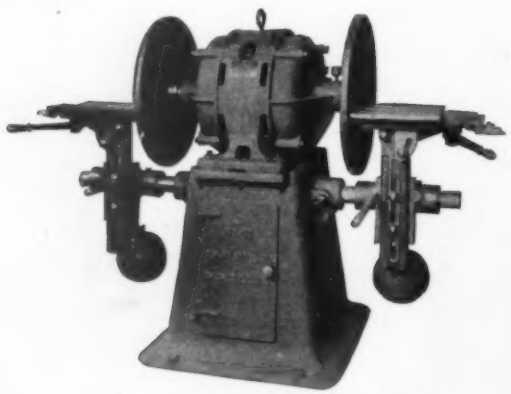
In the Grand Avenue station the series arc machines were continued in service until the summer of 1909. Then followed the installation and operation first of a 300-kilowatt turbogenerator and next of a 500-kilowatt and a 1,000-kilowatt unit. The remaining six 400-ampere direct current machines were taken out in 1911 and this became strictly an alternating-current station. A 1,250-kilowatt Curtis unit was installed, and later two 1,250-kilowatt units and a 2,500-kilowatt unit were added at intervals. The two new 4,000-kilowatt Curtis turbogenerators will be 6,600-volt, three-phase, 60-cycle, horizontal-shaft, condensing machines designed to operate at 1,800 revolutions per minute under 150-pound gauge pressure, 28-inch vacuum, dry steam.

The plant at Bridgeport was started about the same time as the New Haven division, but it was first independent and known as the Bridgeport Electric Company. Development there has been virtually along the same lines as at New Haven, for the practice of purchasing generating apparatus for each station at about the same time has prevailed. The first two turbogenerators installed were of 300-kilowatt and 500-kilowatt capacity. Today there are in operation four 1,250-kilowatt units of the Curtis type manufactured by the General Electric Company. The two new 2,500-kilowatt machines will operate at 3,600 revolutions per minute and will have the same characteristics as the 4,000-kilowatt units in the New Haven station of the United Illuminating Company.

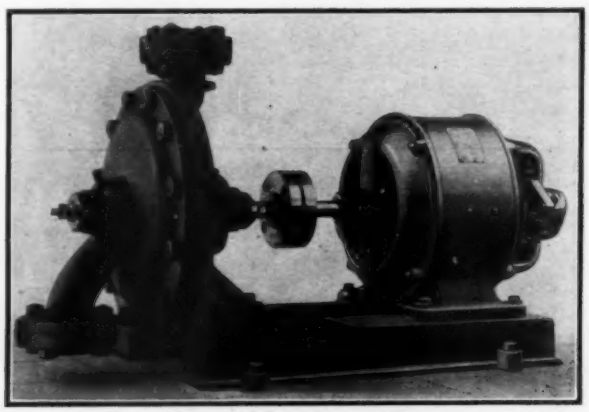
A Direct-Connected Double-Disk Grinder.

The grinder illustrated herewith, which is built for grinding flat surfaces on metal, has the disk mounted directly on the motor shaft and forms a very compact outfit. The motor is a 15-horsepower Westinghouse induction-type machine with special end brackets and extra-heavy bronze bearings. The disks are 26 inches in diameter and 0.8125-inch thick.

The machine is equipped with a geared lever feed table, giving the operator a leverage of 12 to 1. The full pressure sets up a very severe end thrust, which is taken by hardened-tool steel collars running at both ends of the right-hand bearing bushing. This outfit is manufactured by Charles H. Besley & Company, Beloit, Wis.



Motor-Driven Double-Disk Grinder.



Motor-Driven House Pump.

Motor-Driven Worthington House Pump.

The compact pumping unit illustrated has a capacity of 1,000 gallons of water per hour against a head of 100 feet and is used to increase the city water pressure in apartment houses, hotels, office buildings, etc., so as to provide an adequate supply for the upper floors of the buildings.

The pump draws from the city mains and discharges into a tank on the roof. The level of the water in this tank is kept within predetermined limits by an automatic switch which starts and stops the motor at the proper times.

The pump is manufactured by the Henry R. Worthington Company, New York City, and is driven by a one-horsepower Westinghouse electric motor.

Reactive-Factor Meters.

The art of electrical measurements has reached such a state of perfection that the introduction of a totally new type of instrument to measure a quantity not previously directly measurable becomes an event of great interest.

Although instructed to keep the power-factor of the circuits over which they have control as near unity as possible, switchboard attendants often maintain a power-factor of one or two per cent less than unity and do not try to improve it. But computation and tests show that a power-factor of even only one or two per cent less than unity is not as good as it appears to many station attendants, especially on rotary converters. At 98.5 per cent power-factor the armature copper loss in the leading tap coils of a rotary is almost half again as much as at 100 per cent power-factor. Under heavy load this is often enough to cause trouble in the tap coils. Also, the average heating in all the armature coils is about a quarter again as much at 98.5 per cent power-factor as at 100 per cent. The capacity of the rotary is therefore decreased considerably.

The measurement of "idle currents" is in general a recent development, wattmeters having been used recently so connected as to measure the idle volt-amperes, or "wattless component." The reactive-factor meter, however, corresponds in its action to the power-factor meter and bears the same relation to the latter that the "wattless-component meter" bears to the "wattmeter." This meter indicates the sine of the angle of lag or lead, instead of the cosine as in the power-factor meter. Unity power-factor is, therefore, indicated as zero reactive-factor.

If, instead of the power-factor meter, there is on the circuit a reactive-factor meter, a condition of 98.5 power-factor is indicated as 17.5 reactive-factor, and the attendant will be more

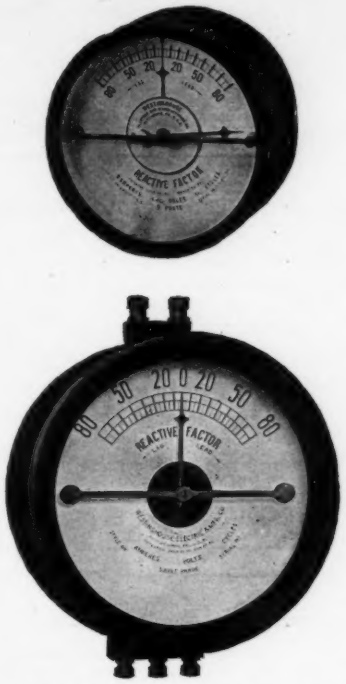
on the alert and will be more apt to improve it.

Power-factor and reactive-factor are equal at the value 70.7 per cent. At higher power-factor, the load conditions are more conspicuously indicated on the reactive-factor scale. At lower power-factors the reverse is true. Reactive-factor meters are therefore recommnded for use only on circuits operating normally at power-factors close to unity and which never fall below 70 per cent.

The reactive-factor meter, which has been recently introduced by the Westinghouse Electric & Manufacturing Company, operates on the rotating-field principle like its power-factor meters, now on the market for several years. A rotating field is produced in angularly placed coils connected in shunt with the metered circuits, one for each phase of the system in the case of polyphase meters. In their field is provided a movable iron vane or armature, magnetized by a stationary coil whose current is proportional and in phase with that of the line current in one phase of the circuit. As the iron vane is attracted or repelled by the rotating field of the angularly placed coils, it takes up a position where the zero of the rotating field occurs at the same instant as zero of its own field. Thus its position indicates the phase angle between the voltage and current of the circuit. The reactive-factor meter is then calibrated to read the sine of the angle indicated while the power-factor meter is calibrated to read the cosine.

In the three-phase meter the rotating field is produced by three coils spaced 60 degrees apart; in the two-phase meter by two coils spaced 90 degrees; in the single-phase meter the rotating field is produced by means of a split-phase winding connected to the voltage circuit.

The Westinghouse reactive-factor meters are inclosed in round dustproof cases, the type SI being 7 inches and the type TI being 9 inches in diameter. They match in appearance the Westinghouse types SM and TM am-



Two Types of Reactive-Factor Meters.

meters, voltmeters, and wattmeters. The entire pointer is visible so that readings are easily made from a distance. No springs are used to control the movement or carry current, nor are there any moving coils, the construction thus being extremely simple. The meters are not influenced by external fields.

Come-Along for Heavy Wire or Cable.

To meet the demand for a wire-stretching clamp or "come-along" for wires and cables larger than one-half inch in diameter, Mathias Klein & Sons, tool manufacturers, Chicago, Ill., have perfected and are now marketing an improved Klein's Haven's clamp, adapted for handling plain or stranded wire or cables up to three-quarters of an inch in diameter.

The particular new feature of construction is the addition of a swing latch, which engages with stud on the lower jaw, thus centralizing the pressure on the cross bolt, which is strongly made of turned, machined steel. The body and handle of this clamp are forged of steel, and the eccentric is made of hardened tool steel.

A Motor-Driven Double Surfacer.

The double surfacer illustrated herewith is unique in its class because it needs no belts, it is direct motor-driven. The upper cylinder is connected to a 40-horsepower and the lower one to a 30-horsepower Westinghouse electric motor. Power is delivered just where it is required and none is wasted in driving countershafts or in belt slippage. Tests show a saving of 25 per cent in power over a similar belt-driven machine.

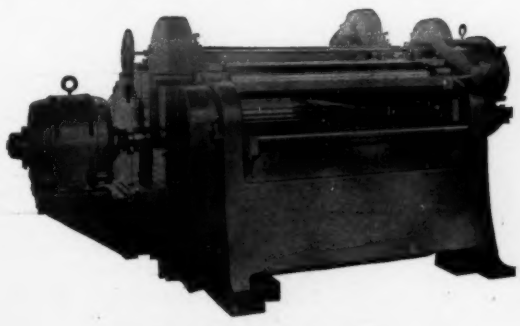
The compactness and simplicity of the machine are obvious. By its use floor space is saved and maintenance expense reduced. The space above it is clear and therefore greater safety is assured to the operators and there are no restrictions as to location.

The feed can be adjusted from 25 to 200 feet per minute, so that each job can be run at the proper speed. Brackets holding the motor have both horizontal and vertical adjustments so they can be brought in line with the cutter heads.

Since the motors are direct-connected they provide a uniform speed; this insures maximum production and a better quality of product, because there is no falling off in speed and no irregularity. The motors drive through flexible couplings, which permit the cylinders to be removed without disturbing the motors and also eliminate all strains on the journals and boxes, even if there should be a slight misalinement between motor and cylinder.

This machine is probably the largest double surfacer ever built. It has 50-inch cylinders and weighs 25,000 pounds. Baxter D. Whitney & Son, Winchendon, Mass., are the manufacturers.

Improved Klein's Haven's Clamp.



Motor-Driven Double Surfacer.

Artistic Lamps for Lincoln Highway.

The Loyal Order of Moose is arranging to install along the section of the Lincoln Highway which runs through Mooseheart, Ill., the home of the order and its industrial school, boulevard lamps which will carry the Lincoln Highway marker worked into the art-glass shades.

The city of De Kalb Ill., is contemplating a like action along the streets of the city which form part of the transcontinental route. Both cities are following the example set by Aurora, Ill., the first to make use of this artistic method of marking.

Montana Plant Nears Completion.

Power from the new Granite County Power Company's plant, which will generate a pressure of 6,600 volts and transmit a distance of approximately six miles to the Royal Basin Mining & Milling Company's property, located at Royal Basin, Mont., is expected to be delivered by the end of the year. The pipe line and dam have been completed.

The power from the new plant will be utilized in driving the grinding machinery, furnishing energy for use in the Fields electrochemical process, and operating the mining equipment. Several small towns in the vicinity of the mine will be furnished power and light, and the line may eventually be extended to the city of Drummond, Mont.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

AUTOSTARTERS.—Lancashire Dynamo & Motor Company, Limited, Trafford Park, Manchester, England.

200-250, 220 and 550 volts, up to and including 100-horsepower sizes. Oil-immersed switches, and air-cooled transformer windings in metal case. With overload and no-voltage release coils. In the "off" position, switches disconnect motor and transformer windings from line.

Overload release is inoperative during process of starting motor. See Rule 78*g* of the National Electrical Code.

This manufacturer also furnish autostarters for circuits of voltages higher than 550 volts. These will be generally acceptable for use when installed in accordance with requirements of inspection departments having jurisdiction.

Approved November 13, 1914.

FIXTURES.—Benjamin Electric Manufacturing Company, 128 South Sangamon Street, Chicago, Ill.

"Benjamin."

Single-socket fixtures, for medium-base lamps, catalog Nos. 1434, 5523, 5524, 5525, 5527, 5545, 5547, 5549.

Approved November 14, 1914.

FIXTURES. Studs for.—The Macallen Company, Macallen and Foundry Streets, Boston, Mass.

"Macallen" spring fixture fasteners, consisting of stud threaded for fixture stem and fitted on hook attached to spring for drawing fixture tight to wall or ceiling.

Non-insulated, Style J, Catalog Nos. 450 to 461, inclusive. Style F, catalog Nos. 470 to 489, inclusive.

Insulated, style R, catalog Nos. 462 to 469, inclusive, for use as combined stud and insulating joint.

Approved November 10, 1914.

FIXTURE PARTS.—National X-Ray Reflector Company, 235 West Jackson Street, Chicago, Ill.

"Nat'l X-Ray Ref. Co." reflector holders used in fixture construction.

75 watts, 125 volts, show-window and show-case reflectors for candelabra lamps, catalog Nos. S-100-S-108 inclusive, with No. 18 B. & S. gauge brass tubing used in assembling parts.

Approved November 11, 1914.

INSULATING JOINTS.—The Macallen Company, Macallen and Foundry Streets, Boston, Mass.

"Macallen" insulated spring fixture fasteners, consisting of stud threaded for fixture stem and fitted on hook attached to spring for drawing fixture tight to wall or ceiling.

Insulated, style R, catalog Nos. 462 to 469, inclusive.

Approved November 10, 1914.

LAMPS,—Incandescent, Gas or Vapor.—Cooper Hewitt Electric Company, Eighth and Grand Streets, Hoboken, N. J.

"Cooper Hewitt" photographic apparatus, 28 amperes, 123 volts; 14 amperes, 250 volts; for two-wire 125-volt and three-wire 125-250-volt direct-current or alternating-current circuits. Frames with vapor-lamp tubes connected to auxiliaries on a main board, either mounted on floor stands or arranged for hanging from ceiling.

Direct-current; floor stand type, type LP floor stand and type NP skylight frame; hanging type, type NP frame and main board.

Alternating-current; floor stand type, type LF floor stand and type NF skylight frame; hanging type, type NF frame and main board.

The amount of current used by this apparatus makes it necessary to connect it permanently, or by proper approved fittings, to a circuit of suitable capacity. It should never be connected to ordinary lighting circuits, nor to ordinary lamp sockets or receptacles.

Approved November 16, 1914.

RECEPTACLES, for Attachment Plugs.—The Arrow Electric Company, Hartford, Conn.

Arrow flush receptacles.

Edison type, 660 watts, 250 volts, catalog No. 1708.

"Chapman," 12 amperes, 250 volts, catalog No. 1363; with plug, catalog No. 1110.

Disappearing door type, 5 amperes, 250 volts; 10 amperes, 125 volts, catalog No. 1700.

Approved November 16, 1914.

RECEPTACLES, for Attachment Plugs.—Crouse-Hinds Company, Syracuse, N. Y.

100 amperes, 125 volts, type BRA receptacles in type BRH, BRHA and UG "Condulets" and with types BPA and BPFA plugs.

30 amperes, 250 volts, 2 and 3-wire, type RYQ receptacles, with type PE cutout bases in type YQ "condulets," and with type RQ plugs.

30 amperes, 250 volts, two and three-wire, types, RQH and RQK receptacles, in type QHC and QKA "condulets" and with type RQ plugs.

Approved November 14, 1914.

RECEPTACLES, Standard.—The Bryant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins" metal-shell, closed or slotted bases.

Twin pull, catalog Nos. AW-17 to AZ-17 inclusive, BA-17 to BH-17 inclusive, BK-17 to BN-17 inclusive, BP-17, BS-17.

Also all of above types with shade-holders attached.

Approved November 14, 1914.

WIRES, Rubber-Covered.—Acorn Insulated Wire Company, 77 Richards Street, Brooklyn, N. Y.

Marking: two blue threads parallel in braid.

Rubber-covered wires shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Approved November 3, 1914.

Current Electrical News

NORTH ATLANTIC STATES.

EAST PROVIDENCE, R. I.—It is proposed to replace the 32-candlepower street lamps in this town by the installation of 48-watt nitrogen-filled lamps. W.

BERGEN, N. Y.—The First National Bank of Batavia, N. Y., has offered to purchase the $4,500 issue of bonds to be used in acquiring a new lightnig plant for the village of Bergen, providing the issue is legally authorized and made a valid obligation by the village.

SILVER CREEK, N. Y.—John Kimmel, of Wayland, is endeavoring to secure a franchise in Silver Creek to erect, maintain and operate an electric light, heat and power plant for 25 years.

DOYLESTOWN, PA.—The Doylestown Electric Company is making arrangements to enlarge the capacity of its power plant on West Ashland Street in order to furnish current to an increasing number of subscribers in the borough, and also for the extension of its lines to the rural districts. Additional electrical generators are to be installed and the building enlarged.

GILBERTSVILLE, PA.—A company is being formed to develop a newly found copper field at this place. A 70-foot shaft has been dug and according to the consulting engineer, a splendid supply of ore can be mined. Electrical machinery will be installed. O. R. Deshler, H. Sofferman and C. Miniri, of Bangor, Pa., are the lessees.

HARRISBURG, PA.—Plans are being considered for the construction and furnishings connected with alterations to be made to the State Capitol Building to cost about $2,100,000. Samuel B. Rambo is Superintendent of Public Buildings and Grounds.

KANE, PA.—The plant of the Kane Electric Light & Power Company was purchased on December 2 by the Interstate Public Utilities Corporation, of Rochester, N. Y. The same corporation recently purchased the electric light plants at Johnsonburg, Pa., and Ridgway, Pa. The capacity of the Kane powerhouse will be doubled in the near future and will supply all the surrounding towns with electricity. The corporation contemplates building a street railway between Kane and the city of St. Marys, Pa.

NORTH CENTRAL STATES.

CINCINNATI, O.—Brilliant street lighting is planned by the Central Vine Street Business Association for that part of the city, and it is probable that the offer of the Union Gas & Electric Company to furnish light will be accepted. The company will furnish 400-watt nitrogen lamps, arranged in the same manner for all business houses, and maintained from dusk to 11 o'clock each evening, for $2.50 a month, a two-year contract. S. B. Waters is president of the Association.

TOLEDO, O.—The National Electric Company has increased its capital from $50,000 to $75,000.

JEFFERSONVILLE, IND.—Among the appropriations to be asked of the next Indiana Legislature will be $1,000 to complete the rewiring of the Indiana Reformatory, D. C. Peyton, superintendent. The 1913 Legislature appropriated $3,500 for underground cables for the institution, but another $1,000 will be required to complete the undertaking.

RICHMOND, IND.—Petitions for the extension of the proposed ornamental lighting system have been presented to the board of works. These petitions will be acted upon after the first of the year.

JANESVILLE, WIS.—The Janesville Electric Company has increased its capital from $100,000 to $200,000.

ST. PAUL, MINN.—H. W. Terry, electrical engineer for the A. H. Stem Company, of St. Paul, recently completed the first big piece of work which he has done in his new position, which consisted in getting out the electrical specifications for the Mannheimer Brothers Building in St. Paul. The building completed will cost about $600,000.

BLENCOE, IOWA.—The Blencoe Electric Light Company, recently organized to furnish electrical energy, has awarded a contract to the Midwest Construction Company, of Omaha, Neb., for the construction of a transmission system from Onawa, Iowa, where current will be purchased. The Blencoe corporation will furnish energy to parties on the line between the two towns. The officers of the company are William Davis, president, W. D. Bassett, vice-president and A. O. Gray, secretary-treasurer.

CORNING, KANS.—The electric light proposition carried at a recent election and the system will be installed at an early date. Service lines will be run in from Centralia or Seneca to furnish current.

SOUTH CENTRAL STATES.

HORSE CAVE, KY.—The interest of Charles Reid in the Reid Milling Company and electric light plant here has been bought by J. K. Scaggs, who will operate under the name of the Skaggs Milling Company, with Porter Howard in charge.

LOUISVILLE, KY.—The Board of Park Commissioners, which controls the park system and parkways of Louisville, is considering throwing out the gasoline lights which have been in use in those parks and substituting therefor an electric service, to be supplied by the Louisville Gas & Electric Company. Definite action has not been taken, though it is said that the Board is likely to order a change at its next session.

PERRYVILLE, KY.—The Perryville Ice and Electric Light Company is to make improvements in its plant. Address mayor.

VINE GROVE, KY.—The Citizens Lighting Company, which owns and operates the electric lighting service here, has increased its capital stock from $3,000 to $5,000. W. E. Crutcher is the principal stockholder. Others interested are E. H. Cox, W. T. McDonough, W. D. Carter and Miss Pearl Stader.

DRESDEN, TENN.—The sum of $12,000 will be expended for an electric light plant. Address mayor.

EL CAMPO, TEX.—The Water and Light Company is to be taken over by a new corporation and will be known as the Central Service Company. This new company will be under the management of Henry L. Doherty & Company, of New York City. It is expected that more than $50,000 will be spent for betterments and improvements during the coming year. The company is to install an up-to-date street-lighting system.

MART, TEX.—The City Council is considering plans for improving the municipal lighting system.

WACO, TEX.—The Texas Power & Light Company will construct a system of power transmission lines to a number of towns in Central Texas from its new power plant here, which was recently finished at a cost of about $1,000,000. The new station will also provide for operating the system of interurban railways of the Southern Traction Company.

YORKTOWN, TEX.—The Southern Texas Electric Company will become the owner of the local light and ice plant on February 1, 1915.

WESTERN STATES.

SANTE FE, N. M.—John Borradalle, of Santa Fe, and associates, are preparing to erect a large hydroelectric plant in White Rock canyon, 15 miles from here. They will build power-transmission lines from the generating station to Santa Fe, Albuquerque, Las Vegas and Socorro. Application for authority to cary out the project has been approved by State Engineer James A. French.

BEAVER, UTAH.—The Beaver River Power Company announces that the new electric power line to the Moscow mine in Western Beaver County was ready for operation on December 1. The electrification of this famous silver-producing property means a greatly increased production for the mine. The increased use of power by the Moscow mine as well as by other properties in this county will probably require the installation of an additional plant by the Beaver River Power Company to take care of its increased demand. Although the company now has 2,000 horsepower available for distribution purposes, it is quite likely that the increasing demand from the various mining enterprises in Beaver, Millard, Sevier, and Piute counties will necessitate the construction of another power plant on the Beaver River on a site held by the company some five miles below the present plant. This additional site is capable of developing 3,000 horsepower.

BRIGHAM CITY, UTAH.—The County Commissioners have authorized the

purchase of the Mantua electric light bonds. The Mantua town board was represented by County Attorney W. J. Lowe. The bonds will be for $3,000 and will run for a number of years. The proceeds from the sale of these bonds will be used for the installation of an electric light distributing system in Mantua, which will purchase power from Brigham.

LEHI, UTAH.—Lehi may own its own municipal power plant. Mayor W. F. Gurney and Councilmen W. S. Evans and William Wing have filed on a power site in American Fork canyon at the mouth of Deer Creek, where it is figured 1,500 horsepower may be developed. The filings call for two pipe lines, one from the main canyon and the other from Deer Creek, to be 18,000 and 5,000 feet long, respectively, which will carry the two streams into a mammoth reservoir to be built on Silver Lake flat, which reservoir, the filings say, will be connected with the power plant by a steel pipe line 7,542 feet long. It is estimated that the plant will cost $150,000. The officials disclaim any present intention of building the plant until after a bill has been gotten through the Legislature giving cities of the third class greater bonding power. Even then the proposition will be first submitted to a vote of the taxpayers.

BOISE, IDAHO.—The Northwest Development Company, a corporation backed by Edward Donlan, of Missoula, former state senator, and his associates, connected with the International Smelting Company, is preparing to invade the Coeur d'Alene mining district with electric power and will shortly begin the construction of transmission lines into that region. The company is now constructing a huge power plant at Thompson Falls, Mont.

SEATTLE, WASH.—A bill appropriating $10,000 from the lighting fund to extend the municipal lighting service to Tukwila, Foster and Riverton, recently passed by the City Council by a vote of seven for and two against, has been vetoed by Mayor H. C. Gill. It is understood the proposition will be put through in spite of the mayor's veto.

SEATLE, WASH.—The City Council will shortly be petitioned by the Lake Burien & Southwest Improvement Club for an extension of city lighting service to the district served by the Highland Park & Lake Burien street railway, known as Division "C", of the municipal railway, lying to the south of the city of Seattle. According to officials of the Improvement Club enough business has been promised to justify making the extension. The Improvement Club is composed of 1,000 members, property owners living in this district, and is directed by 25 business and professional men.

SPOKANE, WASH.—The recently organized Western Union Mines Company has advertised for bids for constructing a central power plant at Republic, capable of generating at least 1,000 electric horsepower.

BAKER, ORE.—A proposal is before the voters for a bond issue of $97,776 for a light plant. Special Engineer L. R. Stockman is preparing plans for the proposed electric light plant.

BERKELEY, CAL.—The City Council has ordered electroliers for University Avenue, from Grove to Third Street and on Brancroft Way from College to Piedmont Avenue. Lights on College Avenue from the University campus to the Berkeley city limits are also being considered.

PROPOSALS.

LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until January 11, 1915, for lighting fixtures for the United States post office at Kinston, N. C. Drawings and specifications may be obtained from the custodian of site at Kinston, N. C., or the supervising architect.

ELECTRIC PASSENGER ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until December 30, for the installation of an electric passenger elevator, hoistway, etc., in the Butler Building at Washington, D. C., in accordance with the drawings and specifications, copies of which may be had at the office of the supervising architect.

LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until January 15, 1915, for the construction complete (including interior lighting fixtures) of the United States post office at Gary, Ind. Drawings and specifications may be obtained from the custodian of site at Gary, Ind., or the supervising architect.

ELECTRICAL EQUIPMENT.—Sealed proposals for installing electrical apparatus in the Children's Ward of the State Sanitorium at Wallum Lake, R. I., will be received at the office of the Board of Control and Supply, Providence, until December 24. Plans and specifications are obtainable of Walter F. Fontaine, Woonsocket, R. I., or at the office of the Board of Control and Supply, Gilbert R. Parker, secretary.

LIGHTING FIXTURES.—Sealed proposals will be received until January 2, 1915, at the office of the Supervising Architect, Treasury Department, Washington, D. C., for the construction (including interior lighting fixtures) of the United States post office at Bozeman, Mont. Drawing and specifications may be obtained from the custodian of the site at Bozeman, Mont., or at the office of the supervising architect.

ELECTRIC PASSENGER ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until December 30, for the removal of the present electric passenger elevator and the furnishing of a new electric passenger elevator in the United States post office and courthouse at Harrisburg, Pa., in accordance with the drawing and specification, copies of which may be obtained at the office of the supervising architect.

ELECTRICAL EQUIPMENT, NAVY DEPARTMENT.—Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until December 22 for furnishing the following electrical equipment: 75 non-watertight buzzers, 312 interior fittings, 48 lighting fixtures with steel reflectors, as per Schedule 7644, for delivery at Navy Yard, Norfolk, Va.; 48,800 feet rubber-covered wire, 500 pounds weatherproof wire; as per Schedule 7650, for delivery at Navy Yard, Brooklyn, N. Y.; 150,000 feet double-conductor wire, miscellaneous resistance, nickel-steel wire, and 20,500 feet twin and single-conductor wire, as per Schedule 7654, for delivery at Navy Yard, Brooklyn, N. Y.; miscellaneous interior communication cable, as per Schedule 7655, for delivery at Navy Yard, Brooklyn, N. Y.

NEW PUBLICATIONS.

PERMEAMETER STUDIES.—Scientific Paper No. 228 of the Bureau of Standards is entitled "An Experimental Study of the Koepsel Permeameter," by C. W. Burrows. The errors to which this instrument is subject are examined.

THERMOPILES.—Scientific Paper No. 229 of the Bureau of Standards is entitled "Various Modifications of Bismuth-Silver Thermopiles Having a Continuous Absorbing Surface," by W. W. Coblentz. This deals with the design of thermopiles and experimental tests.

COPPER-WIRE TABLES.—The Bureau of Standards, Washington, D. C., has issued a third edition of Circular No. 31 entitled "Copper-Wire Tables," and a sixth edition of Circular No. 6, containing lists of fees for electric, magnetic and photometric testing.

OXIDATION OF COAL.—The Bureau of Mines, Washington, D. C., has issued Technical Paper 65, entitled "A Study of the Oxidation of Coal," by H. C. Porter and O. C. Ralston. This describes experiments to determine the nature of oxidation reactions, factors affecting the rate of oxidation, etc.

GRAVITATION.—A paper by Chas. F. Brush, entitled "Discussion of a Kinetic Theory of Gravitation," has been reprinted from *Proceedings of the American Philosophical Society*. This points out certain results of the author's theory that gravitation is due to the shielding action of ponderable bodies from an otherwise universal flow of energy through the ether in all directions.

WATER POWER IN THE UNITED STATES.—An article entitled "The Water-Power Problem in the United States," by R. G. Brown, has been reprinted from the *Yale Law Journal* for November. It was originally prepared for presentation at the International Water Power Congress, which was indefinitely postponed on account of the European war. It discusses the causes of stagnation of water-power development in the United States.

THE WESTERN BLUE BOOK AND BUYERS' REFERENCE.—The twenty-fifth edition of the Western Blue Book and Buyers' Reference is ready for distribution. This book contains a complete classified list of all the constructional engineering, electrical, mechanical, mill, mining, foundry, iron, steel, quarry machinery, railroad and kindred interests for buyers and sellers. It is issued annually by Allen Winch, 504 Sherman Street, Chicago, and will be sent post paid for $5.00.

IMPROVED POWER DEVELOPMENT AT NIAGARA FALLS.—This portfolio illustrates and describes a suggestion for improving the power development at Niagara Falls. The subject has to do with an invention of William H. Baker and comprises a plan for diverting a portion of the water passing over the brink of the falls and conducting it to turbines located in a chamber immediately under the crest of the falls. By this means it is presumed that the scenic effect of the falls would not be impaired and a considerable portion of the power now going to waste would be conserved. The portfolio describes very briefly the method which might be pursued in bringing about the proposed construction.

NEW INCORPORATIONS.

TAHOE, CAL.—The Tahoe Electric & Water Company has been incorporated with a capital of $100,000. Directors, Melville Jeffrey and others.

ROANN, IND.—Roann Light and Power Company; capital $10,000; electricity. Directors: George H. Brodbeck, Dow Van Buskirk, R. F. Schuler and others.

TULSA, OKLA.—Electric Storage Battery Service Company; capital $1,000. Incorporators: H. M. Prewett, J. E. Washington, Jr., and John Y. Morgan, Jr., Tulsa.

HARRISBURG, PA.—Pennsylvania Public Service Corporation; capital $500,000. Incorporators, M. C. Miller, C. W. Hyde, Harrisburg, Pa.; H. W. Davis, Wilmington, Del.

SPRINGFIELD, ILL.—Kansas Mutual Telephone Company has filed articles of incorporation. Capital stock $2,500. Incorporators: E. W. Hall, Curtis Pinnell, R. A. Wilhoit.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the United Electric Company, with a capital stock of $10,000, by G. E. Campbell, P. Santoiemma and F. T. McDougal.

FREEPORT, TEX.—The Freeport Light, Water & Ice Company has been incorporated with a capital of $5,000. The incorporators are C. A. Jones, F. F. Hastings and W. T. Andrews.

CLEVELAND, O.—The K-M-K Company has been incorporated with a capital of $5,000, to handle electric supplies. Incorporators: C. H. Mueller, S. C. Mara, F. M. Ossman, C. H. McConnell, Frank Polasco.

SPRINGFIELD, ILL.—A $25,000 company has been incorporated to build an electric road between Quincy and Hamilton, Ill. The corporation will be known as the Quincy & Hamilton Railway Company.

NEW YORK, N. Y.—Magneto Parts Company, Incorporated. Electrical and other accessories for automobiles, etc. Capital $30,000. Incorporators: Emil M. Lowy, Leo L. Lowy and Alexander S. Hecht, Bronx, New York City.

SOUTH FULTON, TENN.—The South Fulton Light and Power Company has been incorporated with a capital of $2,000. W. C. Moorehead, D. H. Skeen, Herbert Carr, Frank Carr and C. E. Rice are the incorporators. L.

NEW YORK, N. Y.—Hecht's Magneto Exchange, Incorporated. Ignition products and other automobile accessories. Capital $5,000. Incorporated by Alexander S. Hecht, Emil Lowy and Leo L. Lowy, all of 854 Intervale Avenue, Bronx, New York City.

CHICAGO, ILL.—The Allied Electric Company has been incorporated to manufacture, sell and deal in electric fans, etc. Capital $750,000. Incorporators are: W. M. McEwen, Victor P. Arnold, Leo Klein, F. L. Fairbank, all of Chicago.

CHICAGO, ILL.—Burns, Macniven & Company, with a capital of $3,500, has been incorporated to manufacture electrical and mechanical machinery, tools, devices, etc. The incorporators are Arthur W. Burns, Lemoyne G. Burns and Albion P. Holbrook, Jr.

LEWISTON, ME.—The Androscoggin Electric Company has been organized with a capital stock of $2,000,000, being a merger of the Libby and Dingley interests in Lewiston, and the Chisholm interests in Rumford. President, Harold S. Libby; treasurer, Julius E. Parkhurst.

NEW YORK, N. Y.—Day and Night Protective Corporation. To deal in electrical appliances and install burglar alarms, etc. Capital $10,000. Incorporators: Edward Aisenstein and Solon Schiller, 21 Maiden Lane, and David F. Mayer, 261 Broadway, New York.

BROOKYLN, N. Y.—Reliance Chandelier Company, Incorporated. Gas and electric light fixtures, etc. Capital $3,000. Incorporated by Esther Bernard and William Bernard, 1081 Eastern Parkway, Brooklyn, and Isaac Clar, 528 East One Hundred Forty-Ninth Street, New York City.

BROOKLYN, N. Y.—Gaites, Peace & Company, Incorporated. Ornamental brass, electric and gas fixtures. Capital $15,000. Incorporators: Charles F. Peace, 1193 Lincoln Place, Brooklyn; Elijah H. Nostrand, 21 Willett Street, Jamaica, N. Y., and George H. Hammond, 35 Apollo Street, Brooklyn.

BUFFALO, N. Y.—The Standard Chandelier Manufacturing Company, Incorporated. Gas and electric fixtures, etc. Incorporators: John A. Fischer, 625 Elm Street, Buffalo; Charles M. Brenneman, 366 West One Hundred Forty-Third Street, New York City; Fred N. Moffett, 237 Normal Street, Buffalo.

LOUISVILLE, KY. — The Kentucky Revivo Battery Company has been incorporated with $200,000 capital stock for the purpose of manufacturing a patented electrical device, the nature of which has not been given out. A plant will be established. H. W. Embry, Embry Box Company, Louisville, is one of those interested.

NEW YORK, N. Y.—Marpax Manufacturing Company, Incorporated. To manufacture electrical devices for detecting fire, etc. Capital $5,000. Incorporators are: Kathryn C. Marsden, 130 West Forty-seventh Street, New York City; Henry H. Bowman, 153 West Eighty-second Street, New York City, and William McCormack, Vineland, N. J.

PORTLAND, ME.—The Southern Supply Company has been incorporated to do a general electrical business and deal in electrical fixtures. The capital stock is $100,000, and the incorporators are: President, A. F. Jones; treasurer, T. L. Croteau; clerk, James E. Manter. Directors: T. L. Croteau, A. F. Jones, B. M. Maxwell, A. B. Farnham, C. G. Trott. W.

MONTPELIER, VT.—Articles of association are filed with the secretary of state by the Marsden Electric Company of Rutland, with capital of $25,000, divided into shares of $100 each. To carry on general business in electrical and gas supplies for private and publis use. Incorporators: Arthur L. Marsden and Ralph Marsden of Manchester Centre, and L. C. Davis of Manchester Depot.

NEW YORK, N. Y.—The Hydro-Carbon Electric Railway Car Company has been organized to manufacture railway cars which will be operated by hydro-carbon engines in connection with storage batteries, etc. Capital $500. Incorporators: M. E. Harby, Huntington, Long Island, N. Y.; Emy Clauss, 1016 Washington Street, Hoboken, N. J., and Eva De Tranaltes, 170 West Ninety-eighth Street, New York, N. Y.

FINANCIAL NOTES.

Toronto Railway Company has sold to William A. Read & Company, Boston, Mass., an issue of $1,500,000 six per cent notes, due $750,000 December 1, 1915, and $750,000 December 1, 1916. The bankers are offering the notes at 100.25 for the 1915's and par for the 1916's. Surplus over all charges of the Toronto Railway last year was over 18 times the amount for interest on the notes now offered, and exceeds their total face value.

In response to its request for tenders of $2,500,000 of its one-year five per cent gold notes, due March 25, 1915, bankers for Pacific Gas & Electric Company received tenders of $3,751,000 of the notes and of these the company purchased $2,511,000 at prices which netted the company about one per cent as compared with the call prices of the notes. The company also called for redemption by lot November 1, $100,000 general-mortgage sinking-fund 30-year 4.5-per-cent bonds of San Francisco Gas & Electric Company at 105 and interest for the sinking fund of that subsidiary company.

Philadelphia and New York bankers have purchased $1,118,000 six per cent 2.5-year sinking-fund trust certificates of St. Joseph Railway, Light, Heat & Power Company, a subsidiary of Cities Service Company. These are being offered at 97.54. Certificates are secured by the deposit of 31,986 shares out of 35,000 shares of common stock of St. Joseph Railway, Light, Heat & Power Company. Cities Service Company has established a sinking fund for the payment of the $35 a share yet remaining on its purchase price of St. Joseph Railway, Light, Heat & Power common stock, whereby monthly payments of $50,000 and $25,000 will be made to the trustee of the certificates, the entire amount of stock remaining with the trustee until all certificates are retired. The trustee will apply the monthly payments to the immediate purchase in the open market of trust certificates for cancellation at the lowest price at which they can be obtained below par and interest, and otherwise will draw them for cancellation at par and interest.

Dividends.

	Term.	Rate.	Payable.
Ark. Valley Ry., Lt. & Pr., pf.	Q	1.75%	Jan. 15
Brazilian Trac., Lt. & Pr., pf.	Q	1.5 %	Dec. 2
Buffalo Gen. Elec., com.	Q	1.5 %	Dec. 31
California Ry. & Pr., prior pref.	Q	1.75%	Jan. 2
Canadian Gen. Elec.	Q	1.75%	Jan. 1
Cent. St. Elec. Corp. pf.	Q	1.75%	Dec. 31
Columbus Elec. pf.	S-A	$3.00	Jan. 1
Duluth-Superior Trac., com.	Q	1 %	Jan. 2
Duluth-Superior Trac., pf.	Q	1 %	Jan. 2
Eastern Pr. & Lt., pf.	Q	1.5 %	Dec. 15
Indianapolis St. Ry.	S-A	3 %	Jan. 1
Interborough Rap. Tran.	Q	2.5 %	Jan. 2
Interborough Rap. Tran., extra	—	5 %	Jan. 2
Manila Elec. R. R. & Lt.	Q	1.75%	Dec. 31
National Gas, Elec. Lt. & Pr., pf.	Q	1.5 %	Jan. 2
National Gas, Elec. Lt. & Pr., com.	Q	1 %	Jan. 2
Northern Ont. Lt. & Pr., Ltd., pf.	S-A	3 %	Jan. 15
Twin City Rapid Transit, com.	Q	1.5 %	Jan. 2
Twin City Rapid Transit, pf.	Q	1.75%	Jan. 2
Union Trac., Phila.	S-A	$1.50	Jan. 1
United Lt. & Rys., first pf.	Q	1.5 %	Jan. 1
United Lt. & Rys., second pf.	Q	0.75%	Jan. 1
United Trac. & Elec.	Q	1.5 %	Jan. 2
West End St. Ry., pf.	Q	$2.00	Dec. 21
Western Elec.	Q	$2.00	Dec. 31
Western Elec., extra	—	$2.00	Dec. 31

PERSONAL MENTION.

MR. JOHN J. PORTLEY, recently of San Diego, Cal., has been employed in the Commercial Department of the Utah Light & Traction Company at Ogden, Utah.

MR. ROBERT C. BACON, of Brattleboro, Vt., has been appointed chairman of the Vermont Public Service Commission for the balance of the term ending December 31.

MR. R. J. DENEEN, central western representative of the Ohio Brass Company, is again at his desk in Chicago after being confined to his home for about seven weeks with an attack of sciatic neuralgia.

MR. WILLIAM P. BEAR, electrical engineer of the Illinois Public Utilities Commission, has been ill in the German Hospital, Kansas City. His friends will be glad to know that he is rapidly coming around into good condition.

PROF. WALTER NERNST, inventor of the Nernst lamp, and director of the University physical-chemistry laboratory at Berlin, has been decorated with the order of the Iron Cross for distinguished service in the war.

MR. HEMAN M. ALDRICH, an inspector for the Massachusetts Public Service Commission and formerly superintendent of the Amherst & Sunderland Street Railway, Amherst, Mass., has been elected superintendent of the Northampton Street Railway, Northampton, Mass., succeeding Mr. E. C. Clark, resigned.

MR. ELMER A. CLARK, head of the claims department of the Boise Traction Company, has accepted an offer to occupy a similar position with the Utah Power Company where he will have charge of all claim adjustments, rights of way, etc. His headquarters will be in Salt Lake City in the future.

MR. KEMPSTER B. MILLER, consulting engineer and partner of S. G. McMeen, in the firm of McMeen & Miller, has been selected by the receivers of the Central Union Telephone Company as their chief engineer. McMeen & Miller made the plans and estimates for the construction and development work now being done by the big independent merger, the Ohio State Telephone Company.

MR. FRANK E. WATTS has resigned as eastern manager of the *Electrical World* and for the present will make his headquarters at 41 Overlook Avenue, West Orange, N. J. Mr. Watts, before his connection with our contemporary, a little over a year ago, was a general representative of the Sunbeam electric incandescent lamp connected with the office of the Western Electric Company. He was elected Jupiter of the Jovian Order in October, 1913.

MR. FRANCIS V. McGINNESS, sales engineer of the Edison Storage Battery Company, Orange, N. J., has been appointed assistant manager of the Railway Department, taking the position of Mr. William F. Bauer, who was recently made manager of the company's Chicago office. Mr. McGinness is a graduate of Columbia University's School of Applied Science, and before graduation had considerable practical experience with the New York & New Jersey Telephone Company.

MR. ALBERT LAWRENCE SMITH has been admitted as a partner in the firm of E. B. Smith & Company, public-utility bankers, of Philadelphia. Mr. Smith, who is a son of the senior member of the firm, attended Havard University and began his business career with the Franklin National Bank of Philadelphia. For several years he has been associated with the firm of which he is now a partner. He is a director of the Buffalo Susquehanna Railroad, and of the Easton Consolidated Electric Company and is a member of the First City Troop and of the Rittenhouse Club.

MR. CHARLES R. UNDERHILL, chief electrical engineer of the Acme Wire Company, lectured on electromagnets before the senior and junior electrical engineering students at Union University, Schenectady, on December 3. Mr. Underhill showed that the fundamental equation of Maxwell for the mechanical forces due to electromagnets can be successfully applied only when the effects due to the so-called magnetic leakage are properly allowed for. Experiments were made with several forms of electromagnets and numerous lantern slides were used in illustration.

MR. T. C. RINGGOLD, for the last four years sales manager of the Central Electric Company, Chicago, Ill., will sever his connection with that company on December 31. Mr. Ringgold is one of the best known electrical supply men in the country. Prior to his connection with the Central Electric Company he was for many years active in responsible positions with a number of the leading electrical concerns of the country. A man of unusual ability, well posted on conditions in the electrical industry, Mr. Ringgold has a wide circle of intimate friends in every arm of the industry. For the present he will make his Chicago headquarters at 1145 Morse Avenue.

MR. MILTON H. BRONSDON, who was chief engineer of the Rhode Island Company, which operates the traction system of Providence, R. I., and vicinity, from 1907 to 1912, has returned to that post after having been engaged in general engineering work in San Francisco, Cal. During this time the office has been filled by Mr. William Pastell, who recently resigned to accept a position with the B. F. Sturtevant Company, of Boston, at Chicago. Mr. Bronsdon is a native of San Francisco. For several years he was chief engineer at the Rhode Island Company's Eddy Street power plant. Later he was with the Duluth-Superior Traction Company, afterward becoming engineer for the Old Colony Street Railway Company in Massachusetts. Following that Mr. Bronsdon was with the United Railways of San Francisco.

MR. C. R. HUNT has resigned as district wiring-device specialist of the General Electric Company, Chicago, and has been appointed Pacific Coast manager of the Robbins & Myers Company, Springfield, O. Mr. Hunt will have charge of the company's exhibit at the Panama-Pacific International Exposition in San Francisco and at the close of this will maintain permanent offices in San Francisco. Mr. Hunt is a native of California and a graduate of the State University. Leaving school he took the test course of the Crocker-Wheeler Company and later joined the sales organization of the Switchboard Equipment Company. In 1906 he entered the employ of the Cutler-Hammer Manufacturing Company and one year later joined the Chicago force of the General Electric Company. Mr. Hunt is well known in the Middle West and is active in many associations and clubs.

MR. BYRON T. BURT has resigned as general manager of the Chattanooga & Tennessee River Power Company, and will be succeeded by Mr. GEORGE S. BAKER, who was auditor of the company. Mr. Burt will go to Buenos Aires early in the year as manager of the South American Trading Company, and will open the main office of that concern for the sale of American manufactures in Argentina. He has been conspicuous in Chattanooga business circles for several years, having been manager of the old Chattanooga Electric Company until its consolidation with the Chattanooga Railway and Light Company. When the Chattanooga & Tennessee River Power Company was organized to construct the Brady power plant at Hale's Bar on the Tennessee River, he was made general manager. He is an electrical engineer of wide reputation and member of several national scientific organizations. The power company has moved its headquarters into the James Building, owned by C. E. James, associated with the Bradys in the construction of the Hale's Bar plant. The company is now selling wholesale current to the Tennessee Power Company and the Tennessee Valley Light and Power Company, in addition to retailing current in Chattanooga and vicinity. Practically the entire capacity of the Brady plant is now being sold. Mr. Burt enjoys an enviable reputation among Chattanooga business men and manufacturers.

OBITUARY.

MR. LUCIUS TUTTLE, former president of the Boston & Maine Railroad, died at his home in Brookline, Mass., November 30. He was a member of the governing board of the Massachusetts Institute of Technology, Boston, and a trustee of Clark University, Worcester, Mass. He was 68 years of age.

MR. SHERBURNE B. EATON, a prominent lawyer and formerly president of the Edison Electric Light Company, Brooklyn, N. Y., died on December 4. He was 74 years of age and was the senior partner of the law firm of Eaton, Lewis & Rowe. Mr. Eaton was born in Lowell, Mass., and graduated from Yale in 1862. He served with the 124th Regiment of Ohio Volunteers in the Civil War, and was wounded at Atlanta, retiring with the rank of major. He formed the partnership of Carter & Eaton, which, with the accession of Messrs. Daniel H. Chamberlain and William B. Hornblower, was changed to Chamberlain, Carter & Eaton. The firm appeared in some of the most important litigations of the day.

DATES AHEAD.

International Exposition of Safety and Sanitation. Grand Central Palace, New York, N. Y., December 12-19.

South Dakota Independent Telephone Association. Sioux Falls, S. D., December 16-17. Secretary. A. S. Hall, Redfield, S. D.

American Association for the Advancement of Science. Annual meeting, Philadelphia, Pa., December 28, 1914, to January 2, 1915. Secretary, L. O. Howard, Washington, D. C.

Electrical Contractors' Association of Wisconsin. Annual meeting, Milwaukee, January 18-20, 1915. Secretary, Albert Petermann, Milwaukee, Wis.

Independent Telephone Association of America. Annual convention, Hotel Radisson, Minneapolis, Minn., January 19-21, 1915. Secretary, W. S. Vivian, 19 South LaSalle Street, Chicago, Ill.

Western Association of Electrical Inspectors. Annual meeting, Hotel Radisson, Minneapolis, Minn., January 26-28, 1915. Secretary, W. S. Boyd, Chicago.

With the Electrical Manufacturers

The Western Conduit Company, Youngstown, O., has issued a very attractively illustrated booklet showing over 50 fine buildings in San Francisco, Cal., in which its well and favorably known Buckeye conduit is used.

The American Manufacturers' Agency, 111 Monroe Street, Chicago, has been organized with William H. McKinlock as president. Mr. McKinlock recently resigned as president of the Metropolitan Electrical Supply Company and has organized this manufacturers' agency with a strong line of representative electrical material.

The Independent Electric Manufacturing Company, Milwaukee, Wis., announces the changing of its corporate name to **The Industrial Controller Company.** The increasing use of the company's apparatus with industrial companies throughout the country and for industrial purposes is given as a reason for making this change advisable. There will be no change in the personnel of the company, and the trade-mark "I-C" will remain the same.

Stow Manufacturing Company Binghamton, N. Y., has just issued Bulletin 400. This shows about a dozen of its extensive line of electric portable tools. These include drills, grinders, buffers, boring machines, etc. The issuance of this bulletin was prompted by most substantial evidences of returning prosperity in the shape of active demand for Stow tools which have established their reputation by the saving in time and production cost which they bring about.

Kerr Turbine Company, Wellsville, N. Y., builder of "Economy" steam turbines, announces the appointment of A. E. Seelig as general sales manager, and John A. Hense as St. Louis, Mo., representative. Mr. Seelig for several years held a similar position with the L. J. Wing Manufacturing Company, and more recently has managed the new machine-tool department in the New York office of Schuchardt & Schutte. Mr. Hense was formerly with the National Malleable Castings Company, of Chicago, and later with the Dravo-Doyle Company, of Philadelphia.

The Walker Vehicle Company, Chicago, Ill., manufacturer of Walker balance-gear electric trucks, has purchased the business and assets of the Chicago Electric Motor Car Company, and will hereafter manufacture the two types of passenger cars previously manufactured by the latter organization. Practically the entire sales and operating force of the Chicago Electric Motor Car Company has been added to the Walker staff and the salesroom and service station at 2700 South Michigan Avenue will be retained by the Walker Company. All manufacturing will be done at the Walker Company's establishment at Thirty-ninth and Wallace Streets.

A. P. Lundberg & Sons, 477 Liverpool Road, Islington, London, England, has issued a third edition of the booklet entitled "Lektrik Lighting Connections," by W. P. Maycock. This interesting illustrated booklet describes switch connections and switches of all kinds, with the idea of providing for convenient switching control in electric lighting. The new edition comprises about 60 pages and 77 illustrations in excess of the previous edition, and should prove very useful to contractors, engineers, and others concerned with the lay-out of wiring for electric lighting. A charge of twelve cents is made for the booklet, or it is sent post free for fifteen cents.

Record of Electrical Patents.

Issued by the United States Patent Office, December 1, 1914.

1,118,925. Harmonic Ringer. J. Erickson, assignor to Automatic Electric Co., Chicago, Ill. Telephone bell.

1,118,926. Telephone-System Receiver. J. Erickson, assignor to Automatic Electric Co. Has laminated electromagnet core.

1,118,928. Dynamo-Electric Machine. V. A. Fynn, assignor to Wagner Electric Mfg. Co., St. Louis, Mo. Compensated commutator machine with main and auxiliary brushes.

1,118,929. System of Electrical Control. V. A. Fynn, assignor to Wagner Electric Mfg. Co. Master controller governs a motor-actuated main controller and locating switch for the main motor.

1,118,935. Static Frequency-Transformer. M. Joly, Bourg La Reine, France. For transforming to triple frequency; comprises two transformers with primaries in series and secondaries opposed, one transformer having variable permeability.

1,118,940. Method and Means for Gas Ignition. H. Lyon, assignor to Welsbach Light Company, Gloucester City, N. J. Consists in warming a catalytic filament by an electric current.

1,118,941. Ignition Apparatus. H. Lyon, assignor to Welsbach Light Co. Modification of above.

1,118,942. Ignition Device. H. Lyon, assignor to Welsbach Light Co. Further modification.

1,118,943. Gas-Ignition Apparatus. H. Lyon, assignor to Welsbach Light Co. Another modification.

1,118,953. Attachment-Conductor for Electrical Instruments. G. J. Schneider, assignor to Acme Electric Heater Co., Detroit, Mich. Armored cord for flatiron.

1,118,969. Instrument-Dial Illuminator. E. M. Thompson, assignor to Stewart-Warner Speedometer Corporation, Chicago, Ill. Electric lamp reflector behind speedometer dial.

1,118,987. Train-Stopping Apparatus. F. Willock, Scranton, Pa. Includes relay-controlled electric motor.

1,118,991. Gear-Drive for Wringers. O. B. Woodrow, Newton, Iowa. For electric washer.

1,118,993. Electrochemical Process for Producing Nitrogen Compounds. J. W. Wood, Moulton, Iowa. Consists in subjecting a moist alkaline soil to an electric current while forcing air through the soil.

1,119,001. Safety Apparatus for Elevators. R. W. Beardslee, New York, N. Y., assignor of one-half to T. Porter. Interconnection of gate locks and motor controller.

1,119,012. Process of Making Controllers and Parts Thereof. E. Gruenfeldt, Cleveland, O. Drum-type controller segments are cast *en bloc* and then machined.

1,119,016. Recording Toll Trunk-Circuit. J. E. Hilbish, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Has relay-controlled signals for the recording operator.

1,119,024. Primary Battery. H. E. R. Little, New York, N. Y. Has superposed tray-shaped carbon cathodes.

1,119,043. Circuit-Closer. W. E. Russell, Danbury, Conn. Two springs operate pivoted contact member.

1,119,049. Insulator Clamp. A. L. Smith, Nokesville, Va. For clamping wire to annular groove of insulator.

1,119,050. Incandescent-Electric-Lamp Fixture. E. G. Smith and J. J. Dossert, assignors to Crouse-Hinds Co., Syracuse, N. Y. Berth lamp with door-moved sliding carriage for socket.

1,119,057. Junction Box. A. I. Appleton, assignor to Appleton Electric Co., Chicago, Ill. Contains wire-connecting block.

1,119,079. Method of and Apparatus for Electric Welding. E. I. Heinsohn, Cleveland, O. Consists in bringing the edges of a tubular blank into contact, supporting them in overlapped condition by conducting core and carrier, and passing the tube, core and carrier between opposed electrodes.

1,119,080. Automatic Door-Operating Mechanism. R. Hope-Jones, North Tonawanda, N. Y.; C. Hope-Jones, administrator of said R. Hope-Jones, deceased. Electric motor drives revolving door.

1,119,083. Telephone System. B. G. Jamieson, Chicago, Ill. Bright and dim lamp signals for indicating busy condition.

1,119,105. Magneto Generator. T. W. Morgan, assignor to W. W. Marsh, Waterloo, Iowa. Special arrangement of pole pieces.

1,119,117. Telegraph Transmitting System. E. Raymond-Barker, assignor to Commercial Cable Co., New York, N. Y. Includes a circuit-reverser for changing polarity of current for each succeeding impulse.

1,119,119. Induction Coil. G. D. Rogers, assignor to Rogers Electric Laboratories Co., Cleveland, O. Secondary winding is placed on and connected to metallic sleeve, primary is placed over and connected to secondary.

1,119,131. Telephone Relay. H. G. Webster, Chicago, Ill. Multi-contact relay.

1,119,144. Spark Plug. M. Enos, Lemoore, Cal. Has inner rotatable casing.

1,119,150. Method of and Apparatus for Forming Commutators. E. A. Halbleib, assignor to North East Electric Co., Rochester, N. Y. Segments are assembled, then electrically heated and compressed into place.

1,119,151. Power-Transmission Mechanism. A. Halbleib, assignor to North East Electric Co. For motor-dynamo engine starter.

1,119,190. Thermostat. G. J. Ogden, Toronto, Ont., Canada. Actuates circuit-closer.

1,119,193. Thief-Proof Satchel. S. Roth, New York, N. Y. Has electric alarm.

1,119,200. Train-Protector. J. Stofa, Elgin, Ill. Stepping on part of the car platform closes a circuit and releases a gravity-drop curtain.

1,119,203. Pressure Gauge. L. L. Tatum, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Has circuit-closing contacts on the inner edge of the dial.

1,119,209. Electrical Contact. H. J. Wiegand, Milwaukee, Wis. Inverted U-shape in section with depending supporting lugs and an end connection lug.

1,119,225. Motor-Truck. S. J. Bernheimer, assignor to Electromobile Co., St. Louis, Mo. Special chassis construction with chain drive from armature shaft to differential.

1,119,246. Electric Cable. J. H. Cunts, Hoboken, N. J. Capacity is counteracted by increasing the inductance throughout the cable.

1,119,249. Traffic-Controlling System for Railways. A. V. T. Day, assignor to Hall Switch & Signal Co. Transformer interconnection between track signal circuit and motor circuit of car.

1,119,265. Method of Control for Motor Systems. O. P. Fritchle, assignor to Fritchle Automobile & Battery Co., Denver, Colo. Horizontal drum-type controller for electric vehicle.

1,119,282. Brake. A. Hoffman, assignor to E. Becker Maschinenfabrik, Berlin, Germany. Electromagnetic release for centrifugal brake shoes.

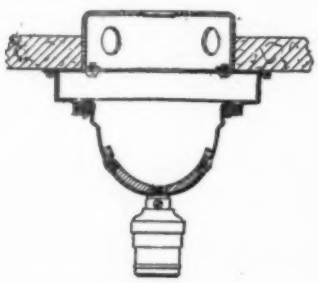
1,119,301. Telephone Table Instrument. G. B. H. Meyer, Hamburg, Germany. Special receiver support.

1,119,302. Spark Plug for Explosive Engines. M. T. Minogue, Philadelphia, Pa., assignor to Superior Motor Specialty Co. Relates to binding-post construction.

1,119,306. Electric Alarm and Automatic Brake-Set for Railways. P. W. Mosher, Stockton, Cal., assignor of one-fourth to H. G. Learned. Includes electrically operated brake.

1,119,313. Secondary Galvanic Battery. H. P. R. L. Pörscke and J. A. E. Achenbach, Hamburg, Germany. Nickel cathode for alkaline storage battery.

1,119,336. Electrical Heating Unit. F. W. Ball, Melbourne, Victoria, Australia. High-resistance wire wound in helical grooves of quartz tubes.



1,119,480.—Canopy Construction.

1,119,355. Telephony. M. L. Johnson, assignor to Frank B. Cook Co., Chicago, Ill. Automatic link connector between switching sections.

1,119,359. Support and Receptacle for Electrical Devices. O. Larsen, assignor to Cutler-Hammer Mfg. Co. Two-part metal casing and insulating lining for feed-through switch.

1,119,366. Support for Telephone Receivers. H. W. Münch, assignor of one-half to C. Münch, Hall, Mass., and one-half to M. W. Springer, Cambridge, Mass. Holds receiver to ear.

1,119,371. Electric Display Control. C. Reilly, Detroit, Mich. Control gear for talking electric sign.

1,119,384. Motor Controller. P. H. Zimmer, assignor to Cutler-Hammer Mfg. Co. Reversing controller with automatic reversing switch.

1,119,387. Electric Motor. F. Baker, Downers Grove, Ill. Inclosed in box with its starting rheostat.

1,119,390. Control System. H. L. Beach, assignor to Westinghouse Electric & Mfg. Co. Has automatic accelerating switches.

1,119,394. Telephone System. J. G. Blessing, assignor to Automatic Electric Co., Chicago, Ill. Relates to calling dial mechanism for automatic telephone.

1,119,397. Current-Transforming Device. A. R. Bullock, Cleveland, O., assignor to H. C. Lee. Commutator with auxiliary condensers.

1,119,420. Vapor Electric Apparatus. L. E. Frost, assignor to Westinghouse Electric & Mfg. Co. Has a conducting shield between the electrodes and a spark gap connected to the shield.

1,119,441. Insulating Compound. J. F. Menninger, assignor to Allis-Chalmers Mfg. Co., Milwaukee, Wis. Contains five parts of sand and hydraulic cement, three parts of asbestos, and four parts of shellac.

1,119,442. Insulating Composition. J. F. Menningen, assignor to Allis-Chalmers Mfg. Co. Contains five parts of hydraulic cement, three parts of asbestos, four parts of shellac, and some coloring matter.

1,119,455. Reflector. M. F. Robbins, Jr., assignor to Wheeler Reflector Co., Boston, Mass. Combined enameled socket-covering canopy and reflector.

1,119,460. Perforating Machine. L. C. Schwensen, New York, N. Y. Gear-driven by superposed electric motor.

1,119,463. Electric Mail-Box. F. L. Smith and P. O. Gaudreau, Burlington, Vt. Electric alarm on box.

1,119,469. Means for Removing Particles of Suspended Matter from Bodies of Gas or Fluid. W. W. Strong and A. F. Nesbit, assignors to R. B. Mellon, Pittsburgh, Pa. High-potential electrostatic precipitation.

1,119,472. Automatic Water-Gas Set. J. H. Taussig, assignor to United Gas Improvement Co., Philadelphia, Pa. Electric valve control.

1,119,480. Lighting Fixture. F. W. Wakefield, assignor to F. W. Wakefield Brass Co., Vermilion, O. Special canopy construction. (See cut).

1,119,484. Metering Panel-Switchboard. J. J. Wesley, assignor to Metropolitan Electric & Mfg. Co., Long Island City, N. Y. Includes transverse rotatable load bars and slidable selective switches on each bar for connecting the load switches to any bus-bar.

1,119,526. Calling Device. G. E. Mueller, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Adjustable impulse-setting call mechanism.

1,119,527. Combination Electrical Switch for Automobiles. G. E. Mueller, assignor to Kellogg Switchboard & Supply Co. Has radially disposed setting members.

1,119,571. Optical Pyrometer. A. C. Burleigh, Sewickley, Pa. Has glass cylinder for observing the color of an element heated by an electric current.

1,119,576. Protection Device for Street Cars. E. E. F. Creighton, assignor to General Electric Co. Electrolytic lightning arrester.

1,119,579. Cooking Apparatus. F. V. Detwiler, Chicago, Ill. Electric "fireless" cooker with heat-insulated walls.

1,119,590. Locking Device for Switches. H. G. French, assignor to General Electric Co. Locking latch-biasing and release mechanism.

1,119,600. Asymmetrical Vapor-Conducting Medium for Alternating Currents. O. Holz, assignor to General Electric Co. Mercury-arc rectifier with several anode chambers.

1,119,602. Combination Stop Mechanism for Organs. R. Hope-Jones, assignor to Rudolph Wurlitzer Mfg. Co., North Tonawanda, N. Y. Electric control system.

1,119,616. Contact-Making Voltmeter. H. A. Laycock, assignor to General Electric Co. Includes means dependent upon abnormal decrease in voltage for interchanging the connections to one of the contact points.

1,119,618. Chandelier and Fixture. W. Lumley, assignor to General Electric Co. A cap at end of fixture arm supports a pendent socket.

1,119,620. Automatic Train-Stop System. E. G. Mascarenhas, Juiz de Fora, Brazil. Controlled by track circuits.

1,119,639. Demand Apparatus. L. T. Robinson, assignor to General Electric Co. Maximum-demand indicator auxiliary to watthour meter.

1,119,660. Electromagnetic Actuating Mechanism. H. M. Stevens, assignor to General Electric Co. For an electric switch.

1,119,663. Electric Pocket Lamp. J. G. Swallow, New York, N. Y. The lamp is pivotally mounted on top of the battery casing.

1,119,670. Switch. M. C. Arnold, Hastings, Nebr. For connecting a single telegraph resonator to any of the sounder circuits.

1,119,674. Spark Plug. W. T. M. Besson, Selma, Ala., assignor of one-half to H. A. Vaughan. Covers details.

1,119,681. Electromagnetic Selective Device. W. S. Burnett, assignor to Morse Code Signal Co., Milwaukee, Wis. Provides selector at each station.

1,119,687. Electric Conducting Mechanism. J. Delaney, Couer d'Alene, Idaho. Pantograph trolley for electric car.

1,119,692. Selective Calling System. M. F. Geer and R. C. Leake, assignors to General Railway Signal Co., Gates, N. Y. Combined A. C. and D. C. selector at each station.

1,119,701. Electric Imprinter. F. Hyder, Pittsfield, Mass. Electromagnetically actuated.

1,119,718. Binding Device for Panelboards. R. H. Olley, assignor to Crouse-Hinds Co., Syracuse, N. Y. Terminal post with conducting rings and insulating sleeves.

1,119,719. Switch Mechanism. E. J. Pace, assignor to National Street & Station Indicator Co., Los Angeles, Cal. Includes electromagnetically actuated pivoted needle.

1,119,732. Apparatus for Transmitting Electrical Energy. N. Tesla, New York, N. Y. A circuit connected to ground and to an elevated terminal and having its outer conducting boundaries, which are subject to high tension, arranged in surfaces of large radii of curvature so as to prevent leakage. (See cut.)

1,119,738. Station-Box for Watchmen and Fire-Alarm Signaling. F. Williams, assignor to Acme Register Co., Somerville, Mass. A push rod actuates the circuit-closer.

1,119,740. Automatic Train-Arrester and Railroad Signal System. G. A. Wilson, Jr., Boston, Mass. An electric motor operates speed-reducing device.

1,119,741. Induction Motor. E. F. W. Alexanderson, assignor to General Electric Co. Combined ventilating vane and end ring construction.

1,119,782. Telephone Support. C. J. Landin, assignor to Universal Appliance Co., Boston, Mass. For holding a desk set in adjustable positions.

Patents Expired.

The following United States electrical patents expired December 7, 1914.

594,872. Electric Soldering-Iron. F. H. Harriman, Hartford, Conn.

594,879. Potential Switch. J. D. Ihlder, Yonkers, N. Y.

1,119,732.—High-Tension Wireless Oscillator.

594,882. Electric Cable. J. H. Kelman, Pittsfield, Mass.

594,908. Fuse Plug. D. A. Schutt, Peru, Ind.

594,913. Trolley Connection for Canal-Boats. F. J. Shewring, Toronto, Canada.

594,917. Electric Battery. W. A. Storm, New York, N. Y.

594,928. Electric Arc Lamp. H. M. Baker, Jr., and A. W. Fox, Brooklyn, N. Y.

594,932. Terminal for Electric Conductors. W. P. Booth, South Bend, Ind.

594,944. Electric Switch. F. A. Gilbert, Brookline, Mass.

594,979. Telephone Selective Signaling. J. A. Barrett, Brooklyn, N. Y.

594,998. Conduit for Electric Wires. R. W. Lyle, Perth Amboy, N. J.

595,004. Telephone Circuit. G. K. Thompson, Malden, Mass.

595,007. Elevator. G. Westinghouse, Jr., Pittsburgh, Pa.

595,008. Electric Railway. G. Westinghouse, Pittsburgh, Pa., and W. Chapman, Washington, D. C.

595,016. Electrical Igniter for Gas Engines. B. W. Grist and E. Cellison, Philadelphia, Pa.

595,078. Multiple Circuit Block. D. A. Schutt, Peru, Ind.

595,080. Trolley-Arm for Electric Railways. S. H. Short, Cleveland, O.

595,086. Electric Elevator Controller. C. M. Weymann, San Francisco, Cal.

595,096. Electric Alarm Device. I. FitzGerald, Hartford, and J. Fay, Yalesville, Conn.

595,132. Secondary Battery. R. Ashley, Port Republic, N. J.

595,208. Storage Battery. J. D. Rively, Pittsburgh, Pa.